MUNICIPAL WORK IN AMERICA

Papers and Reports Presented to the Sixth Annual Convention of AMERICAN SOCIETY MUNICIPAL IMPROVEMENTS

Vol. XVII. November, 1899. No. 5.

PAVING SEWERAGE

MUNICIPAL ENGINEERING

WATERWORKS PARKS

A MONTHLY MAGAZINE.

DEVOTED TO THE IMPROVEMENT OF CITIES.

GOOD ROADS, STREET CONSTRUCTION,
CLEANING AND LIGHTING,
SANITATION,
BRIDGES.

PUBLISHED BY
MUNICIPAL ENGINEERING COMPANY
INDIANAPOLIS NEW YORK

FEB 7 190

Two Dollars Per Year. Single Copies, 25 Cents.

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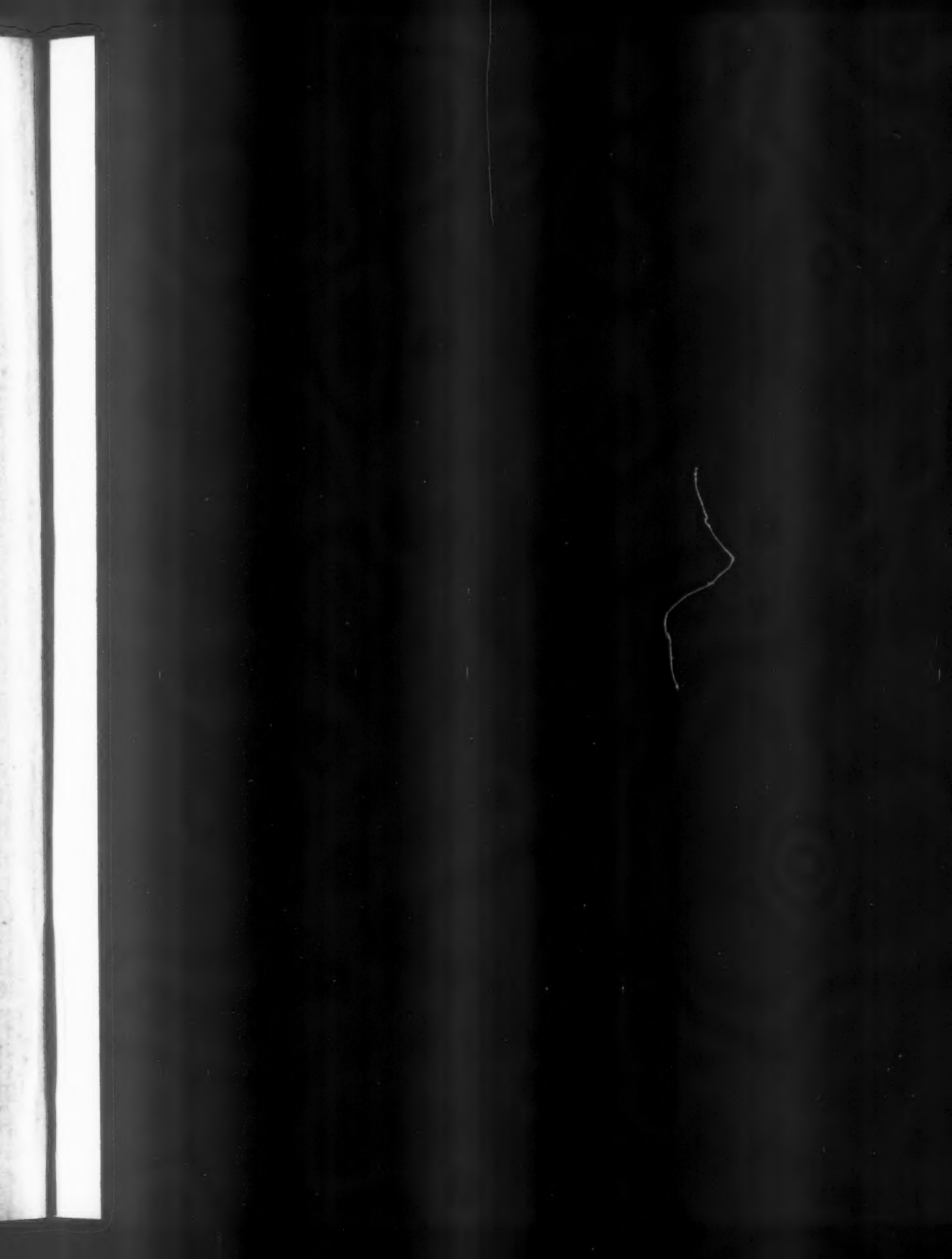
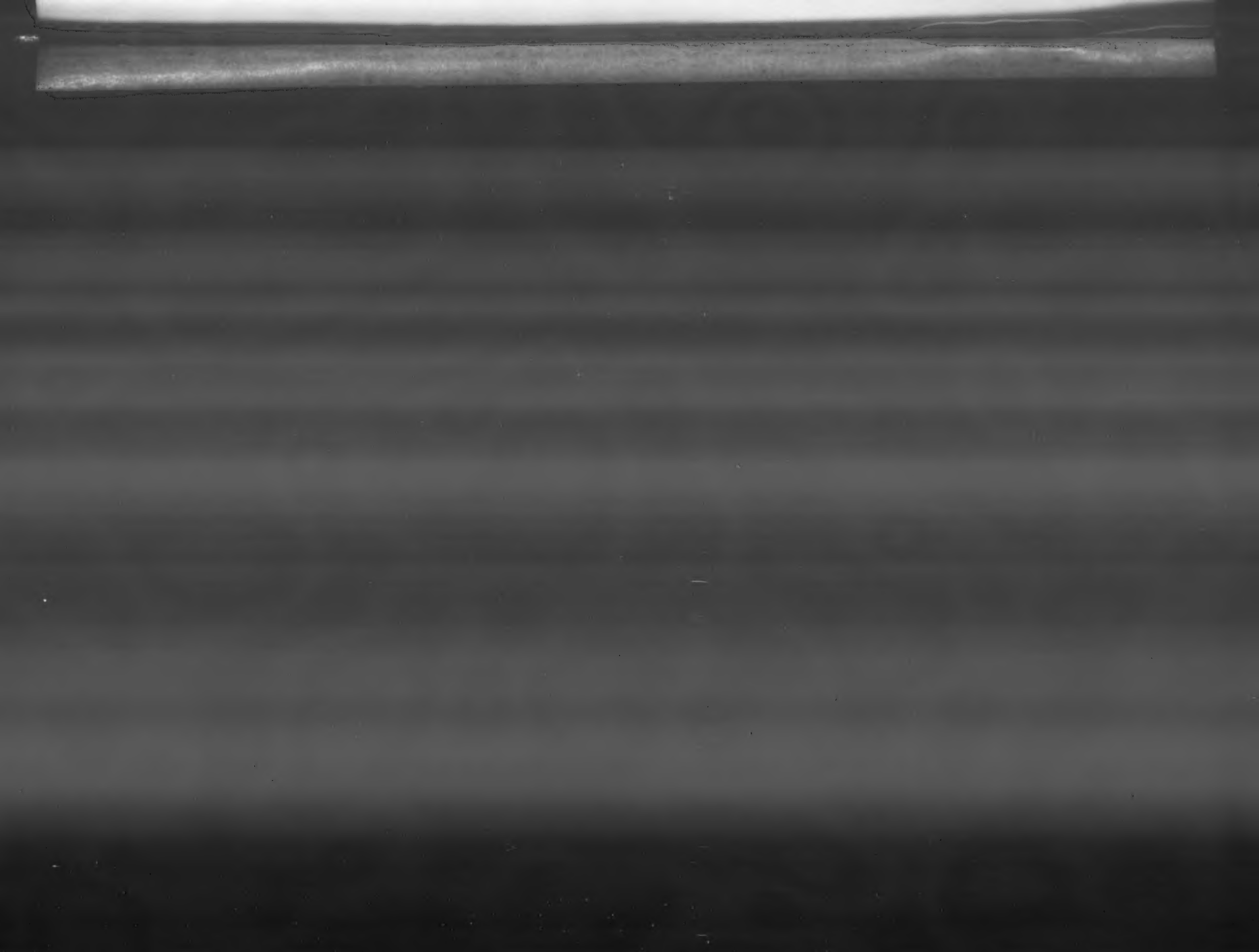




Municipal Engineering

VOLUME XVII. NOVEMBER, EIGHTEEN NINETY-NINE. NUMBER 5.

MUNICIPAL WORK IN AMERICA.

PAPERS READ AND DISCUSSED AT THE SIXTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

The sixth annual meeting of the American Society of Municipal Improvements held in Toronto, Ont., October 3d, 4th and 5th, proved the most important and interesting meeting of city officials ever held on the American continent. The committee reports and papers presented were devoted to the consideration of practical city affairs, and they disseminated a vast amount of valuable information and data regarding a wide variety of municipal questions. About forty cities of the United States and Canada were represented, notwithstanding the extreme northerly location of the meeting place. The convention met in the new city hall, which is one of the finest municipal buildings in America, on the morning of October 3d, where the delegates were heartily welcomed to the city by Mayor Shaw, who was attended by a number of the aldermen. After a response by President Lewis, the regular business of the convention was opened by the annual address of the president.

He noted the unprecedented attention being devoted to municipal improvements and the universal tendency among all peoples of the world to concentrate in large cities. Greater New York, containing nearly 50 per cent. of the population of the State of New York, was given as an example of such concentration and some of the resultant complications of municipal affairs were cited. The following figures were given to indicate the enormous expenditures for public improvements in cities of the United States, during 1898.

There are 212 cities in the United States of 15,000 population or more, and a total population of 17,298,662 and from the returns made by 78 of them, assuming these to have been a fair average, the expenditure during 1898 for municipal improvements have been:

Streets	$49,301,187
Water supply	32,867,458
Sewage	14,057,142
Public lighting and buildings	26,779,847
Parks and bridges	22,198,566

The cost of police and fire protection reached the enormous sum of $66,339,023.

These figures underestimate rather than overestimate actual expenditure. The figures quoted do not include the vast sums expended for water front improvements, education, libraries, museums, public baths, markets, charities and corrections. Other vast sums are spent for purposes distinctly municipal, in which members of the society are deeply interested, but which it is the almost universal custom to leave to private enterprise, such as railways for urban and inter-urban

travel, supplying light, heat and power, telegraph and telephone, etc.

The objects of the association and the results it has secured were briefly discussed by President Lewis. It was pointed out that in the future development of the country, the municipal officers will be the men who will bear the greatest responsibilities, and men who have been tried and found efficient will be retained in office, and they would not see, as they had in the past year, three important officers in the three most progressive cities of the Northwest, allowed to retire after many years of faithful service because they were not in political sympathy with their mayors.

The president concluded his address with the following glowing prophesy of future possibilities:

> As we look forward, dim figures appear through the mists of futurity bearing different legends,—social reform, the brotherhood of man, universal peace, sound finance, national ownership of railways and many others. Some walk with faltering step, uncertain of their place upon this stage, but one figure more commanding than the rest bears the legend, "Municipal Administration." Among the jewels of her crown are: Wise economy, fidelity to public trust, good sanitation, civic pride, sure tenure of office for faithful employes. Is this only an illusion? It must be realized if the people are to appreciate the importance of the problems which confront them. In helping them to such a realization this society can play an important part, and I earnestly hope it may materially contribute to that end.

The routine work opened by the admission of a large number of new members. The reports of the secretary and treasurer showed the total receipts of the year to be $1,059.97, with total disbursements, including about $200 on old outstanding debts, of $975.20. Balance on hand, $84.77. After deducting a total outstanding indebtedness of about $40, there was still shown a small balance in the treasury.

Following this business session the convention held five meetings, at which committee reports and papers were presented and discussed. These papers and reports will appear in this magazine, and no attempt will be made here, therefore, to abstract them. The afternoon and evening sessions of the first day were devoted almost entirely to the reports of the various committees. The report of the Committee on Electric Street Lighting, by David Hunter, Jr., superintendent electric light plant Allegheny, Pa., chairman, contained some valuable statistics and suggestions.

The report of the Committee on Sewerage and Sanitation was not presented because of the unavoidable absence through sickness of Captain Lansing H. Beach, Engineer Commissioner, Washington, D. C. As a substitute there was presented a paper entitled, "Is a House Sewer Trap Always Necessary?" by Charles B. Ball, M. Am. Soc. C. E., Inspector of Plumbing, Washington, D. C. A great diversity of opinion was evidenced in the discussion of this question. Mr. G. H. Benzenburg, Milwaukee, Wis., advocated the use of a main trap on the house connection under all circumstances. He cited the danger, where the main trap is omitted, of disease germs and sewer gas penetrating the building through defective plumbing or neglected and unused fixtures. Mr. A. D. Thompson, Peoria, Ill., briefly alluded to the methods employed in England to secure ventilation of the sewers. Mr. G. M. Ames, Grand Rapids, Mich., and Mr. Ernest Adams, Newark, N. J., stated that ventilation had been satisfactorily secured in their cities through perforated manhole covers. Mr. Robert E. McMath, St. Louis,

Mo., called attention to the fact that ventilation through soil pipes would be effective only during a small portion of the year, as the end of the house connection is sealed when the sewer is running one-half full. He also noted the difficulty in getting architects to extend the soil pipes above the roof, as they persisted in placing them in low places where they would not be conspicuous. Mr. C. H. Rust, Toronto, Canada, stated that they had attempted to secure sewer ventilation through numerous small pipes attached to and extending above buildings, but had experienced considerable difficulty in securing the consent of property-owners for such attachment.

The general conclusion reached was that it is safer to use a main trap on the service pipe and secure ventilation through perforated manhole and lamphole covers or, where this becomes offensive, to ventilate through pipes attached to buildings.

The question of sewage disposal was also briefly discussed and the septic tank method explained.

A report of the Committee on Municipal Data, by Charles C. Brown, M. Am. Soc. C. E., Bloomington, Ill., chairman, was presented. In the absence of the chairman the report was read by Mr. A. D. Thompson, member of the committe. The report dealt with a very important question and led to an extended discussion. This society was the first organization to advocate the collection of statistics regarding municipal matters, and the committee last year presented standard forms for information regarding water-works, street construction and sewers.

President Lewis stated that he had been in correspondence with the director of the census regarding the collection of municipal statistics in the next census and had received assurances that the matter would be given consideration after the regular census work of the bureau was disposed of. The American Society of Civil Engineers have this matter also under consideration and a short time since a special committee on the subject was appointed. The chairman of this committee, Mr. S. Whinery, New York, being present, stated that they also had been in communication with the director of the census and had received about the same assurances. He outlined the objects which the committee desired to accomplish, together with their probable future action.

Mr. G. W. Tillson, Brooklyn, explained the difficulties encountered in securing reliable information regarding such statistics, and cited as an example two tables recently published in MUNICIPAL ENGINEERING giving information upon street improvements, in various cities. The tables covered the same period, but one was compiled by that periodical and the other by a contributor. Six cities appeared in both tables, but the statistics were the same only in one case. The differences reached as much as 50 per cent. in one of the cases.

Several members stated that they had been visited during the past year by parties representing the government who were collecting municipal statistics. The presence of these agents was explained by Mr. M. N. Baker, who stated that a recent act of congress authorized the commissioner of labor, Mr. Carroll D. Wright, to collect statistics from cities with a population of 30,000 or more. He also stated that labor bureaus of several of the states together with that of the general government have, for several years, collected statistics

relating to the public and private ownership of water and electric light plants.

The general sentiment of the members was that it would be productive of better results to confine the statistics to be secured by the census bureau to general questions, and not attempt, for the present, to secure detailed information which would discourage all effort because of the magnitude of the project. A motion was adopted authorizing the president to appoint a special committee of five members to confer with the director of the census and take steps toward securing municipal statistics in the coming census and a permanent bureau for the collection and publication of such statistics each year. The committee were also directed to co-operate with the special committee appointed on the same subject by the American Society of Civil Engineers and all other technical organizations who might take the subject under consideration. The president appointed the following committee: August Herrmann, President Water Board, Cincinnati, Ohio; A. D. Thompson, City Engineer, Peoria, Ill.; C. C. Brown, Consulting Engineer, Bloomington, Ill.; Dr. W. C. Woodward, Health Commissioner, Washington, D. C., and M. R. Sherrerd, Engineer Water Board, Newark, N. J.

The evening session of Tuesday opened with the report of the Committee on Taxation and Assessment by August Hermann, President Water Commissioners, Cincinnati, Ohio, chairman. Mr. Hermann confined the report to the consideration of the water rates in 31 cities of the United States. Mr. Benzenburg stated that in Milwaukee there are 26,000 metered services and about 8,500 services not metered. No minimum meter rate was charged in 1897, but the consumer was charged at the rate of 20 cents per 1,000 gallons. By this method nearly 2,000 consumers had bills between 15 cents and $1 for the entire year. The next year a minimum meter charge of $1 was made and the rate reduced to 6 cents per 1,000 gallons. It was estimated that on this basis about 12,000 services would pay less than $2 for the year. Mr. Benzenburg also explained the methods employed in determining the amount of water used for city purposes, such as watering troughs, drinking fountains, sewer flushing, parks, city buildings, street sprinkling, etc.

No report was received from the Committee on Electrolysis, but a paper on this subject has been prepared by the chairman, Mr. Harold P. Brown, which will be printed with the proceedings.

The final paper considered at the evening session was entitled "Electrolysis from the Standpoint of a Municipal Electrician" by Mr. H. S. Wynkoop, Electrician of the Department of Public Buildings, Lighting and Supplies, Brooklyn, N. Y. The author being absent, the paper was presented by Mr. Tillson. In the discussion of this paper, a number of members cited cases where considerable damage had resulted from electrolysis. The railway companies in nearly every instance denied the existence of such a condition. Mr. M. R. Sherrerd, Newark, N. J., stated that the street railway company of that city had assumed one-half the cost for replacing services injured by electrolytic action along one street. Mr. N. P. Lewis cited an instance in Brooklyn where the contractors for asphalt pavements have been called upon, under their

guaranty, to replace a considerable amount of pavement destroyed by leaking gas. The gas company claims the leakage is due to holes in the mains caused by electrolysis. Mr. A. D. Thompson explained the causes of the current reaching the ground and gave a statement of a case in court at present between the Peoria Water Co. and the Central and Prospect Heights Street Railway Companies. This case is not for damages but to compel the railway companies to care for the return current in such a manner that it will not be injurious to the underground pipes. The point was raised that the escape of the return current from the rail might be prevented by cast-weld joints.

The morning of the second day, October 4th, was devoted to a tour of the city, over the principal electric lines in special cars provided through the courtesy of the Toronto Railway Co., of which Mr. E. H. Keating, formerly city engineer of Toronto, is manager. The city park was visited and a good general view of the business and residence portion of the city was obtained. A large number of delegates also accepted the invitation of Mr. S. Whinery and made an early morning visit to the plant of the Warren-Scharf Asphalt Paving Co.

The afternoon session was devoted entirely to the consideration of street pavements. After all the papers were presented, the entire subject was opened for discussion. The following papers were read:

Report of the committee on street paving, by the chairman of the committee, Edwin A. Fisher, city engineer, Rochester, N. Y.

"The Life of Pavements," by George W. Tillson, principal assistant engineer, department of highways, Brooklyn, N. Y.

"Brick Pavements in Various Cities, as Viewed by an Observer in Search of Information Relating to the Subject," by L. M. Hastings, city engineer, Cambridge, Mass.

"The Physical Properties of Asphalt," by W. H. Broadhurst, chemist of the department of highways, Brooklyn, N. Y.

"Damages from Non-Repair of Highways," by Hon. James S. Fullerton, Queen's Counsel, Toronto, Ont.

"Creosoted Wooden Block Pavements in Indianapolis," by M. A. Downing, president board of public works, Indianapolis, Ind.

"Paving Between Street Railway Tracks in Toronto," by C. A. Rust, city engineer, Toronto, Ont.

In the discussion which followed a great deal of attention was paid to the best filler for brick pavements and to the cause of rumbling in this class of street improvement. Mr. Ernest Adam urged in support of cement grout filler that it added five years to the life of a pavement, because it prevented the chipping of the edges of the bricks. Mr. A. D. Thompson disapproved of cement grout for a filler, because it formed a masonry arch of the pavement, and not only prevented the brick from expanding in warm weather, but added its own expansion. He considered this filler responsible for the rumbling in brick pavements by reason of small cavities between the brick and sand, which would not occur if the brick were free to settle to the sand cushion. Tar becomes brittle in winter and soft in summer. He recommended sand for a cheap, satisfactory filler on streets having not over a grade of 4 or 5 per cent. On heavier grades an asphalt filler was suggested, as the sand would wash out of the interstices. The sand does not allow admission of moisture beneath the bricks. Mr. Wallace, of St. Thomas, stated that he used a cement filler, but attempted to care for the expansion of the bricks by an asphalt filler for a certain width next the curb and across the street every twenty-five feet. Mr. G. W. Tillson believed the rumbling on brick

pavements due to small cavities beneath the bricks. He believed the asphalt filler along the curb would not prevent the rumbling. He agreed with Mr. Adams that cement filler added five years to the life of a pavement. He also explained the trouble experienced in Brooklyn, N. Y., a few years ago because of the rumbling on a brick paved street. The brick were removed and replaced with asphalt after every endeavor had been made to stop the noise.

The evening session of Wednesday was given over to the consideration of water-works questions, the election of officers and the selection of the next place of meeting. Prior to the regular work, two postponed papers by Mr. Bouton and Mr. Eldridge were submitted. The first paper considered was by Mr. G. T. Bouton on "Special Assessments." Mr. Van Duyne gave the practice in Newark in levying special assessments. In former years the total cost of an improvement was assessed against the property. The assessments in some instances equaled and even exceeded the value of the property and a change was demanded. Now all assessments are made by a board of experts and are limited in amount to the benefits received, the city making good any deficiency that may occur. About seventy-five per cent. of the cost of improvements is thus borne by the property-owners.

"Some Experience with Portland Cement," by W. K. Eldridge, City Engineer, Lafayette, Ind., was a very valuable contribution, giving the results of experiments upon the strength of different cements by adding various proportions of sulphate. It was not discussed.

The report of the Committee on Water-works and Water Supply, by M. R. Sherrerd, Engineer and Superintendent, Department of Water, Newark, N. J., chairman, was followed by a talk illustrated with lantern slides on the Albany filtration plant by Allen Hazen, Consulting Engineer, New York. The illustrations presented photographs of this plant. All the details of construction, operation and cost were given by Mr. Hazen in an interesting talk. At the conclusion of the talk, a vote of thanks was tendered Mr. Hazen by the society.

Upon the report of the nominating committee the following officers were unanimously chosen for the ensuing year:

President—A. D. Thompson, Peoria, Ill.
First Vice-President—Robert E. McMath, St. Louis, Mo.
Second Vice-President—Bernard Saunders, Toronto, Ont.
Third Vice-President—Dr. W. C. Woodward, Washington, D. C.
Secretary—D. L. Fulton, Allegheny, Pa.
Treasurer—F. J. O'Brien, Oswego, N. Y.
Finance Committee—W. B. Howe, Concord, N. H.; Joseph Emmer, Grand Rapids, Mich.; W. S. Cook, New Bedford, Mass.

Milwaukee was unanimously chosen as the next place of meeting. Detroit and Peoria also presented invitations for the next meeting, and Buffalo filed an invitation for the meeting in 1901.

The following report of the executive committee was received and the by-laws presented therein were adopted.

Your executive committee, after examining the reports of the secretary, treasurer and finance committee, desires to congratulate the society upon the fact that for the first time since its organization it is able to state that all its obligations have been liquidated and there remains a cash balance in the treasury to-day. In order to regulate the manner of distribution for publication of the papers submitted to the society, your committee recommend that the following be adopted as a by-law of the association.

No. 1. Members shall not be permitted to give out for publication any papers to

A. D. THOMPSON.

President of the American Society of Municipal Improvements.

Mr. Almon D. Thompson, the newly elected president of the American Society of Municipal Improvements, is widely known as one of the most progressive municipal engineers in America. Since he became city engineer of Peoria, Ill., in 1895, he has been prominent in engineering organizations. He was chairman of the committee on standard specifications and tests for paving brick and sewer pipe, appointed by the Illinois Society of Engineers and Surveyors in 1895, the first committee ever appointed by an engineering society to investigate these subjects. He has been a leader among municipal engineers in developing knowledge of paving brick and brick pavements, and his work in this direction has brought him into prominence in the organized work of the paving brick people. He is serving his second term as president of the Illinois Society of Engineers and Surveyors. He has from the first year of its organization been one of the most active and valuable members of the American Society of Municipal Improvements. He was chairman of the committee on street paving in 1896 and 1897, was elected first vice-president in 1898, and his advancement to the presidency of the organization was an instance of natural selection of the best available man. He has written much on the subjects connected with his technical work, and since September 1, 1899, has been an associate editor of MUNICIPAL ENGINEERING, with special charge of matters pertaining to paving brick and brick pavements. It is noteworthy that the honor of being put at the head of America's foremost organization of municipal officials comes to Mr. Thompson at an age so early as thirty-one years, he having been born in 1868, at Gilman, Ill. He graduated from the College of Engineering of the University of Illinois in 1893.

be submitted to the society at its annual meetings, in advance of such meetings, and all requests for papers for such purpose shall be referred to the secretary.

No. 2. All committees and members of the society shall be required to furnish four copies of all reports, papers or other matters submitted to the society for its consideration.

Your committee is of the opinion that some decisive steps should be taken to not only increase the membership of the society, but to maintain its present membership as well, and to secure representation for future meetings from those cities which have acquired a membership in the past, although not represented by officials at present. For that reason we recommend the adoption of the following by-law.

No. 3. It shall be the duty of the president, on or before the 1st of January of each year, to divide America by states into territorial sections, and to assign one or more members of the executive committee to each of said sections.

It shall be the duty of members of the executive committee thus assigned to keep an accurate list of the municipalities and members of the society in the particular territory assigned to them; and to ascertain, from time to time, whether or not the members of the society from the territory assigned to them are still municipal officers, and when not to take such steps as may be necessary to secure new members from such municipalities as well as to secure membership in the society of such municipalities and officials in the territory assigned to them that have not acquired the same in the past.

Your committee also recommend that they be authorized to prepare for publication and distribution a brief history of the society, and what it has accomplished, and print 1,000 copies of the same in pamphlet form of not exceeding twenty-four pages, the same to be distributed by them not later than August 1, 1900, to municipalities and officials not now members of the society, with an invitation or request to become members and attend the next annual meeting.

Your committee also recommend the adoption of the following by-law:

No. 4 The president shall be required, at least sixty days before the holding of the annual conventions, to communicate with the local committee having charge of the arrangements of the convention, in the city in which the same is to be held, with a view of securing exact data as to place of meeting, entertainment to be furnished, hotel rates, etc., and to print this information, together with such data relating to the business of the convention as he may have, and turn the same over to the secretary or members of the executive committee for distribution.

Upon the urgent request of the local committee on entertainment the program for Thursday morning was postponed, and the time devoted to a tallyho ride over the city as the guests of the officials. The college, parliament buildings, golf links, reservoir grounds and points of interest throughout the city were visited. At 1 o'clock there was a working exhibition at the city hall of the DuGary automatic catch basin cleaner.

The concluding session of the convention was held Thursday afternoon, and was devoted to the consideration of sanitary matters and reports of committees. The following papers and reports were given:

Report of the Committee on Disposition of Garbage and Street Cleaning, by Dr. W. C. Woodward, Health Officer, Washington, D. C., chairman.

"The Collection and Disposal of Garbage in the City of Cincinnati," by August Herrmann, Commissioner of Water-Works, Cincinnati, Ohio.

"Garbage Disposal in Toronto," by John Jones, Street Commissioner, Toronto, Ont.

The limited time available prevented an extended discussion of these questions, and they did not receive the attention their importance warranted. Mr. Drake, of Buffalo, gave a history of the garbage question in his city. He favored the contract system for collection and disposal of garbage, and showed how the cost to his city had decreased each year.

The report of the Committee on City Government and Legislation was not submitted. The chairman, Mr. F. W. Cappelen, Consulting Engineer, St. Paul, Minn., has expended a large amount of work on this subject, and has in process of compilation a most valuable and thorough report, which will be published with the proceedings.

The report of the Committee on

Review, by George H. Benzenberg, Consulting Engineer, Milwaukee, Wis., consisted of a most painstaking summary of interesting data from the reports of city officials. This report represented an enormous amount of detailed investigation.

Resolutions were adopted thanking the city officials and citizens of Toronto, the local press, the Toronto Street Railway and others for courtesies extended during the meeting.

The special committees on coating of cast-iron and steel pipes and on electrolysis were on motion discontinued.

The following chairmen for the standing committees for 1900 were announced by President Thompson:

Street Paving — George W. Tillson, Brooklyn, N. Y.

Sewage and Sanitation—W. K. Eldridge, Lafayette, Ind.

Water-works and Water Supply—George H. Benzenberg, Milwaukee, Wis.

Taxation and Assessments — August Herrmann, Cincinnati, O.

City Government and Legislation—Charles F. Herr, Newark, N. J.

Disposition of Garbage and Street Cleaning—John Jones, Toronto, Ont.

Municipal Franchises — Capt. M. M. Drake, Buffalo, N. Y.

Review—George M. Ames, Grand Rapids, Mich.

Municipal Data—C. C. Brown, Bloomington, Ill.

The president was authorized to appoint a special committee on park development and maintenance. This committee will be announced later.

The chairman of the committee on electric street lighting was not selected.

The delegates who remained in the city Thursday night were treated to an exhibition drill of the Royal Grenadiers, an organization that corresponds to the state militia in the United States.

REPORT OF THE COMMITTEE ON ELECTRIC STREET LIGHTING.

The committee on electric street lighting, Mr. D. Hunter, jr., chairman, submitted a report, of which the following is the most important part:

"Your committee desires to call your attention to what it considers more or less improper methods prevailing in the matter of contracts existing between municipalities and lighting companies for the lighting of the public highways by means of the electric arc lamp. The existing form of contract calls for a certain type of lamp, commercially known as being capable of rendering 1,200 or 2,000 candle power, using power to the amount of 330 and 480 watts respectively, operating under normal conditions, and for which the municipality agrees to pay a fixed price per lamp per annum, same to be in service a fixed number of hours. With the above form of contract it is possible, and in many cases probable, that the current furnished to lamps will be very much reduced, the company thereby economizing in fuel, carbons and apparatus, while the municipality suffers a corresponding loss in illumination, and, as a natural consequence, complaints come from the public to the city officials, claiming the light is poor and it is not getting what it pays for.

"Another matter requiring some attention is that of the adjustment of outages. In the present form of contract it is customary for the company to allow a rebate (corresponding to the contract price) for all lamps not burning. This has the appearance of being fair to all concerned, but many outages occur that escape the notice of the municipal officials, even under the most rigid methods of inspection, and all such leaks must be borne by the municipality.

"Your committee is of the opinion that the troubles mentioned may be removed entirely by the adoption of the meter system, under which you will pay only for current used. The contracting company being in the business to sell current, will then find it to its interest to maintain normal current on its street lighting circuits and take better care of lamps in order to reduce outage account. The best service within the power of the company to render will then be obtained by the municipality, with but slight effort on the part of the latter.

"With the adoption of the meter system

it would be necessary for the representative of the municipality to have access to the meters operating in street lighting circuits, enabling him to take two daily readings of each street lighting circuit watt meter, one reading previous to lights on, and one at time lights are cut off.

"Knowing the number of lamps on each circuit and wattage of same, daily comparisons should be made between meter readings and approximately-known circuit wattage, and it will then be possible to discover at once any considerable error in meter and have same rectified immediately. In making the above comparisons it is, of course, understood that allowance must be made for line resistance, making, say two miles of circuit of average construction the equivalent of one arc lamp. In other words, a circuit ten miles long, operating sixty arc lamps, may be computed for wattage as having sixty-five lamps in circuit. In ordinary practice the above will be found approximately correct. All meters should be calibrated monthly.

"All other details in contracts may remain as at present, including that of rebate for outages, except that the contract might concede a fixed percentage of same, and anything above that should be charged against the company, at such rate as may be determined in contract, provided all such excess outages might have been prevented by the exercise of proper care.

"The meter system will necessitate closer observance in the matter of supervising the lighting of the city, as it will prohibit the joint operation of public and commercial circuits.

"A question naturally arising in the event of the adoption of the meter system is that of price per kilowatt hour for current used under existing service. It would probably be as well to leave this unanswered, knowing as we do that local influences and conditions control these matters, as may be seen by referring to tabulations embodied in this report. However, comparison may be made as follows: An arc lamp using 9.6 ampere current at 50 volts (2,000 candle power so-called) consumes power at the rate of .480 kilowatts, for which the average cost is 2.81 cents per lamp hour as per tabulation of seventy-eight cities under contract, or at the rate of 5.85 cents per kilowatt hour.

"Average cost per 2,000 candle-power lamp hour, computed from twenty-five electric plants owned and operated by municipalities is 2.17 cents, being equivalent to 4.51 cents per kilowatt hour. Interest, depreciation and insurance are included in municipal plant cost of service.

"To those desiring to make detailed investigation of the cost of electric plants and service from same the reports of the cities of Detroit and Allegheny may be found valuable."

REPORT OF THE COMMITTEE ON MUNICIPAL DATA.

To the President and Members, A. S. M. I.:

Gentlemen—Your Committee on Municipal Data presents again the forms of report of municipal operation of water works, street paving and sewer construction departments, which were presented last year and renews its recommendations as follows:

An examination of the annual reports of municipal departments shows great lack of uniformity. Much of this is due to the great differences in methods of keeping accounts, and of beginning and carrying forward public works, on account of differences in state laws, in city charters and in local conditions. Your committee is of opinion, however, that the variations in form and matter of reports can be reduced very greatly by agreement to follow, as closely as laws and fixed methods will permit, forms of report proposed by such a body as this and recommended by you and by competent governmental authority as models for the municipalities of the nation.

There are in many reports evidences of lack of co-ordination of departments; of duplication of reports, under circumstances such as to render them even contradictory of each other; of separation of work among several departments which should properly belong to one; and of consequent inability to obtain any adequate idea of the economy of operation of the departments, and to prevent duplications and omissions, which produce waste and serious difficulties. Co-ordination and co-operation of departments will be facilitated by forms such as are proposed, if the city departments are required by law or ordinance to co-operate in giving full information upon the various items of the schedules in their annual reports.

Many reports, especially among the smaller cities, are very meager in their statements regarding the operation of the departments in their technical details, while they are very full of detail as to the exact amount paid on each individual voucher allowed during the year. The forms proposed, so far as they are applicable, will bring order out of this chaos, and enable the authorities to see the extravagance or economy of their methods of construction and operation. Many points of a similar nature might be made.

It is doubtless true that circumstances vary so greatly in different localities that comparisons of operations in different cities are not satisfactory, and in some cases are misleading, but the fact remains that very valuable conclusions can be drawn from general comparisons of this sort, and much im-

portant information gathered from the study of such reports. The schedules presented herewith are intended to cover the larger items, such as can most readily be compared in reports of different municipalities, but they are also intended, as indicated therein, as models upon which to form other more detailed schedules, covering the most minute items of construction and operation if desired. The comparison of reports made on such schedules from year to year, is perhaps the most valuable use to be made of the scheme, an intelligent study of the reports enabling the authorities to discover the places where errors of judgment have been made, and to determine where improvements in methods may be made, and the results of adopted methods of procedure. The exact forms of these detailed schedules depend so closely on the local circumstances and the personal preferences of the supervisors of the work, that they are left to the judgment of these officers without recommendation.

The general lines of reports are so nearly alike in the nature of the case, that it is believed the forms presented, when modified by the collective wisdom of this society can be closely followed to great advantage, individually and collectively by nearly all cities.

The committee presents forms of waterworks reports prepared by the chairman, of sewerage reports prepared by Mr. Beach, and of street reports prepared by Mr. Thompson, each having had special opportunities for study in the line assigned to him.

It is recommended that, when the schedules are amended, enlarged and adopted by the society, a resolution be adopted recommending the adoption of the schedules by the census bureau as the forms for reports requested by that office from the municipalities of the nation, and that a committee be appointed to present this resolution to the proper authorities, to press it upon their attention, and to secure adoption if possible.

The establishment of a new bureau in any department of the government is a serious matter, requiring much thought and great labor. To what department the bureau of municipal data proposed by Mr. Herrmann should be assigned is the first question for consideration. It is the opinion of this committee that a permanent census bureau is a desideratum. The collection of municipal statistics pertains properly to such a bureau. Your committee, therefore, recommends the passage of resolutions recommending the establishment of a permanent census bureau, with powers and facilities for collection of various kinds of statistics at any and all times as required by congress, and for the inclusion of a bureau of municipal statistics in the permanent provision for departments in such permanent census bureau; such census bureau may or may not be independent of the organization making the usual count of population and industries every ten years. A committee should be appointed to present this resolution to congress.

(The report of the committee here set forth the forms for report as published in Municipal Engineering for November and December, 1898).

The last convention of the Am. Soc. C. E. showed some interest in the collection of data regarding the operation of municipalities and appointed a committee to try to impress upon the authorities in charge of the census the great desirability of the collection of such data by one or more of the special agents of the census department. An offer of co-operation should be passed by this convention and the combination of effort of these two societies and others that may express an interest will aid in securing the desired results.

The passage of strong resolutions by the convention of the Am. Soc. C. E. and the appointment of the committee are the only expressions of interest in the question which our committee has had under consideration that we have been able to discover. Lack of time has prevented much personal solicitation of opinions by the individual members of the committee and lack of an appropriation for expenses has prevented the sending of a circular letter. An appeal to the members of the society at the last convention and in the volume of proceedings has brought no response. A similar appeal to an engineering society by one of the committee has likewise failed to bring any assistance in criticism or addition. Appeals by the chairman almost monthly in Municipal Engineering Magazine, which most of you see more or less frequently, brought no responses until last month, and these were not from members of the society. The committee has therefore concluded that there is not the absorbing interest in the subject which its importance seemed to insure, and which ex-President Herrmann assumed would be elicited by a report upon the matter. This does not modify the opinion of the committee that the subject matter of this report is of very great importance and that all its recommendations, if put into effect, will be of very material assistance to municipal authorities in bringing order out of the present chaos in most city department reports.

The committee still asks for criticism and earnestly recommends prompt action upon the corrected report. We have done the best we know how and it rests with you to take the next steps. This is the last opportunity to take action before the forms of census reports are fixed and the collection of information is begun. Whatever action is deemed proper by the society must therefore be taken by this meeting.

Respectfully submitted,

CHAS. C. BROWN, Chairman.

LANSING H. BEACH,

ALMON D. THOMPSON,

Committee.

REPORT OF THE COMMITTEE ON STREET CLEANING AND DISPOSAL OF GARBAGE.

Dr. W. C. Woodward, health officer of Washington, D. C., as chairman of the committee on street cleaning and disposition of garbage, submitted a report, which, in part, was as follows:

"The most marked feature of the present methods of collecting and disposing of city wastes is the absence of uniformity. So far as can be seen this does not depend upon differences in form of municipal organization or in municipal needs, but is an indication of the varying stages which the cities have reached in the evolution of complete and perfect systems of collecting and disposing of such material. The progress of such evolution has been rapid during recent years, but much time and money has been, and is being, wasted by the duplication of investigations by different cities. Much can be done by the efforts of this organization which will prevent such waste, if its representatives are properly supported by the officials of the various cities from which they seek information. While many inquiries have been answered promptly, many, I regret to say, have been ignored, or answered in a perfunctory manner, and as a result the work of your committee has been rendered more difficult. The results accomplished will be more valuable, too, if such of the cities as have membership in this society will indicate, from time to time, such special data as they desire, so that it can be collected by your committee and made available to the entire membership.

"It appears from the inquiries that have been made that in many cities only kitchen waste—garbage or swill—is collected at public expense, and so far as can be judged from such investigations as are being made, generally no extension of the service is contemplated. It is worthy of note that in our older and larger cities as a rule all wastes are collected through some municipal agency. It is, moreover, apparent that such material can be controlled in no other manner, and that uncontrolled it soon becomes a nuisance and may be dangerous to health. In the opinion of your committee, therefore, any service to be created, or any proposed modification of an existing service, should be designed to include within the scope of its operations the collection of ashes, garbage, dead animals, night soil, miscellaneous refuse and street sweepings; and the collection of the contents of manure pits, if not so effected, should be regulated as to time and manner of performance. If it be not possible to organize such a service at once, any service which may be organized should be devised so as to be susceptible of being expanded so as to include such work.

"With reference to the performance of whatever work be undertaken, your committee is of opinion that it can be done better and more economically by the city through its own employes than through the agency of a contractor. In reaching this conclusion it has been influenced by the following reasons: (1) A contractor, in fixing the amount of his bid, must base his estimated cost of the service upon the probability that at the end of some limited period he will go out of the business, and that his plant will then be nearly a dead loss. His bid must, therefore, include an amount sufficient to relieve him from such loss. Even a long term contract will not prevent this, for his plant must be kept in good condition even up to and including the last day of his contract in order to enable him to do his work. On the other hand, if the service be performed by the city, the plant may be counted as a permanent investment; each part of it will be used for the entire period of its natural life, and, therefore, no such loss will be encountered. (2) If the work be done by contract, the service must be organized anew with the advent of each contractor, and during this period of organization efficient work cannot be accomplished. Aside from the question of organization itself, the personnel of the service will be changed each time, new workmen will be unable to perform their duties properly until they have learned them by experience, and such experience must be acquired at the expense of the community. On the other hand, if the city does the work the organization will be permanent, subject to only such changes as are necessitated to better it. The employes will have a permanent tenure of office and after they have once learned their duties will become more and more proficient during each year of their service. (3) If the work be done by contract the contractor must have a corps of inspectors to see that his employes perform their duties properly, and it will be necessary for the city to have a similar force to see that the work is properly done by him, but if the work be done by the city one force of inspectors will be sufficient. (4) If the work be done by contract there will usually be several contractors—one for street cleaning, one for collection of garbage, etc.—each maintaining a separate plant and organization. But if the work be done by the city all the advantages will accrue which arise from the performance of all such enterprises on a large scale. (5) If such work be done by contract, there is a conflict between the sanitary requirements and the features essential to secure the greatest money profit, and, as the contractor is in the business for the money he can get out of it, it is needless to say that the financial features will receive first consideration. On the other hand, if the work be done by the city, the sanitary as-

pects alone will have to be considered, and there will be no inducement whatsoever to neglect them. (6) If the work be done by contract, the city authorities are more or less free of responsibility to the people; they can put the blame for poor service on the contractor or on the details of the contract. But if the work be immediately under the control of the city officers, they must answer to the people whom they serve for the character of the service rendered. Your committee has not regarded the effects which politics may have on any service which may be under the immediate control of the city. While, unfortunately, this is a factor which must be regarded in any community, it does not enter into the determination of the abstract question. If a community is willing that the municipal services, or any of them, shall be performed less efficiently and more extravagantly because of political influences—that is, if it desires that a part of the money nominally appropriated for cleaning the streets, or for removing the garbage, shall be devoted in fact to political purposes—there is no reason why it should not have it so; but this is a matter which your committee is unwilling to admit as an essential part of the problem of municipal scavengering.

Briefly, whatever may have been the case when the removal and disposal of city wastes were regarded as simple problems and the work could be done and supervised by unskilled labor, in the view of this problem which is now generally accepted, there is no argument for doing such work by contract which is not equally valid when urged in favor of performing the services of the police and fire departments, and of the public schools, in the same way.

Your committee is aware that in some cities the problem of providing funds to meet the cost of such municipal scavengering as has been proposed, the collection of all city wastes, is a more or less difficult one. In considering it, however, it must be remembered that such work must be done, whether its actual performance devolves upon the householder or upon the municipality. If the former be the case the householder must pay the cost to some personal agent of his own selection and procurement. There seems to be reason, therefore, why, if the interests of the city will be served thereby, he should not be required to pay the cost of such work to the local government, in the form of a special tax, if necessary, in consideration of the service to be rendered by it.

In conclusion, your committee recommends: (1) That all municipal scavengering be performed at municipal expense; (2) that all services necessary for the performance of such work be performed by the city directly and not through the agency of contractors; and (3) that, if necessary, a special tax be levied to meet the cost of such work.

REPORT OF THE COMMITTEE ON STREET PAVING.

To the President and Members of the American Society of Municipal Improvements:

Gentlemen—Your Committee on Street Paving has given attention during the year to various details of the subject, and has endeavored by correspondence and personal solicitation to obtain papers of interest to the society. While the responses have not been as general as was desirable, it is hoped that the additional time thereby available for the discussion of the various subdivisions of the subject will be fully utilized by the members present.

Your committee last year gave special attention to the following four heads under the general subject of "Street Pavements:"

1. The selection of paving material.
2. Railroad track construction in paved streets.
3. The obligations of street railroads and other corporations as to maintenance of pavements between their tracks and over their subsurface constructions.
4. Regulations to restrict and control the opening of pavements by corporations, plumbers and others.

In the opinion of the committee the subdivisions above given cover a field of investigation so extensive and of such permanent interest to the members of the society that the time given to the report of your present committee cannot be better employed than in following out the lines of investigation suggested under the foregoing subdivisions.

The first two subjects received attention, both in papers and discussions, at our last convention in Washington, and are fully reported in the "Proceedings." It is not our purpose to again go over the ground so well treated before. It is of interest, however, to note that the conclusions stated by your former committee with respect to permanent track constructions in paved streets receive the sanction of both municipal and railway officials, and the construction recommended is being very generally adopted. In the city of Rochester, N. Y., a large amount of paving was done in streets occupied by street railway tracks during the year 1898, and a much larger amount is now going on. All of the permanent track work, and the pavement, are of the most durable construction, and fully in accord with the principles stated by your former committee.

The manner in which the streets are to be paved and kept in repair, in connection with street railways, gas and electric subways, and other public utilities, we can very profitably consider.

The so-called repair gangs of these corpor-

ations, together with the openings made for water services and lot laterals, can and do destroy pavements more than all the legitimate wear to which they are subjected.

The street railways have more to do with street pavements than any other of the public services. The mileage of all street railways in 1898 in the United States and Canada is given in the Street Railway Journal of February, 1899, as 17,934 miles, having a capitalization of $1,650,000,000. Assuming that 25 per cent. of this mileage is outside of city streets, the balance, 13,473 miles, has, within the rails and for two feet outside thereof, about 71,000,000 square yards of pavement. Assume the cost of pavement at $2 per square yard we have the enormous sum of

E. A. FISHER,

City Engineer of Rochester, N. Y., Chairman of Committee on Street Paving, Am. Soc. M. I.

$142,000,000 as the first cost of this pavement.

What is the best method of making and keeping in repair permanent pavements in streets occupied by railway tracks, having reference to the rights and duties of both railway company and the municipality? Several methods are in use in accomplishing this end. First, and most general, when the railway company is under obligation to pave and repair that pavement between the rails and for a specified width outside thereof. As a rule, the general acts and special character provisions relating to this matter are so vague as to be the cause of constant controversy between the municipal and railway officials.

The second plan is for the municipality to take entire charge of the street paving and repairs, the railway company paying a direct tax for the use of the street. Perhaps the best and the most perfect illustration of the undivided care of streets having car tracks is within your observation, in the city where we are assembled. Here, the city builds the roadbed to receive the railroad construction and receives a rental of $800 per mile of single track, together with a tax on gross earnings for the use of the tracks and the franchise.

In Philadelphia the conditions with respect to paving are the reverse of those existing in Toronto. There the railway company, have, since 1892, paved and maintained the streets in which they operate cars, from curb to curb. The length of streets occupied exceeds that of any other city, due to the fact that in most streets only one track is allowed. The cars generally run in opposite directions in neighboring streets. Up to Dec. 31, 1897, 226 miles of permanent pavement, mostly asphalt, have been laid entirely at the expense of the company; the cost of which is estimated at $12,000,000. The street work has been done under the general supervision of the Department of Public Works by contract. Although the relations between city and railway officials have been generally satisfactory, the director of public works recommends that hereafter all street construction be done by the city authorities, and expense thereof charged to the companies. He is of the opinion that there should be no division of responsibility as to street constructions and repairs.

A committee appointed by the governor of Massachusetts investigated the relations between cities and towns and street railway companies, in the years 1897 and 1898. This committee was composed of Charles Francis Adams, William W. Crapo and Elihu B. Hayes, with Walter S. Allen, clerk. The investigation was most thorough and comprehensive, covering existing conditions generally in America and Europe. The high character of the members composing this committee, and the reputation for thorough and effective pioneer work by the state of Massachusetts in investigations relating to matters of public concern, should give much weight to the conclusions of this committee.

Massachusetts also has within its comparatively small area 1,644 miles of street railway tracks, or over 9 per cent. of the entire mileage in the United States and Canada; the amount being exceeded by only two other states, viz.: New York standing first with 2,293 miles; Pennsylvania second with 1,693 miles; Massachusetts being third with 1,644 miles. The total mileage of the United Kingdom company of England, Scotland, Ireland and Wales is given in said Massachusetts report in 1896 as only 1,468 miles, or nearly 200 miles less than the mileage of Massachusetts. Mr. Robert P. Porter also states that the entire mileage of all Europe, with a population of over 400,800,000, was about 7,500 miles, which is 1,000 miles less than the combined mileage of the five states of New York, Pennsylvania, Massachusetts, Ohio and Illinois.

The committee in its report to the legislature says: "Reference has been made to three lines of ultimate development into which the relations of street railway interests and municipalities seem now in this and other countries to naturally work: (1) That of regulated private ownership; (2) that of the municipal ownership of a permanent way to be operated by a private company as lessee; and (3) municipalization. The first of these lines of development is that which through the street railway interests of the commonwealth have grown up, and its advantages and defects are well understood. The chief objection to it is obvious—it necessarily involves a divided control of streets, resulting in continual jealousies, misapprehensions and disputes. While, because of its apparent simplicity, as well as from the analogy of the steam railroad, it naturally suggested itself in the early and experimental stages of street railway development, it certainly does not now commend itself as a permanent or scientific arrangement. Even should it be continued indefinitely the committee is clearly of opinion that it would be conducive to a better state of affairs were the municipalities to assume full control of the streets, meeting all charges for paving, for street cleaning, etc., and receiving therefor from the companies a net annual money payment in lieu of work in kind. This would be in the nature of a commutation—a pavement and cleaning tax to be paid by the company in consideration of the special provision made in streets for its exclusive use."

The committee submitted drafts of proposed laws, embodying the conclusions arrived at in their report, and during the last summer the statute went into effect.

The general tenor of the report of the Massachusetts committee was strongly and unequivocally in favor of an undivided care and control of street pavements by the municipality, the question of compensation from the railway companies being taken care of by direct taxation.

The rapid progress now going on in automobile construction may soon result in placing upon the streets of our cities lines of these carriages in competition with existing street railway lines. In justice to the community and to the vested interests of the street railway this new industry should contribute its proper proportion toward the improvement and care of streets through which it may operate; not by doing any part of the work and thus creating more confusion, but by the payment of a direct tax applicable to said construction and repair.

Your committee in this discussion has purposely left out all reference to the method of taxation, or the amount to be charged the railway companies, in lieu of making pavements and repairs, as this will have to be adjusted to the conditions existing in the various localities.

Your committee would respectfully submit as its final conclusion upon this subject that the construction and repair of pavements in all streets, whether occupied by railway tracks or otherwise, should be directly under the control of, and done by, the municipal authorities; and that where existing laws do not permit of this being done, an effort should be made to have said laws so amended as to permit of the work being so done; the compensation to the city for the use of streets to be made by a direct tax, instead of the indirect method of requiring work to be done.

Your committee would also recommend the consideration of the plan of the city, in some cases, owning the track construction in paved streets, and charging the railway company operating over tracks a rental, as recommended by the Massachusetts report previously referred to.

(The committee quoted from reports of many city engineers to show the extent of destruction of pavements by street openings and gave the following conclusions:)

1. That previously to the paving or repaving of a street all underground work of any kind that will probably be required within the life of the pavement be put in, as far as possible, and that the work of backfilling all trenches in a street under improvement be done, wherever possible, by the contractor who lays and guarantees the pavement, or if the work cannot be done by the said contractor it should be done subject to his inspection and approval, as well as that of the municipal inspectors.

2. That no excavations of any nature, except for emergency repairs of existing pipes and fixtures, shall be permitted in any street except upon the written application of the individual or corporation desiring to make said excavation, and the filing of a proper indemnity bond. All work, except repaving, to be done by licensed contractors under the immediate supervision of inspectors employed by the municipality. The repaving to be done either by the city, or by the contractor guaranteeing the pavement, when the same is under guarantee. All costs of inspection and repaving to be paid by the owner or corporation desiring the service. Said costs to include guaranteeing the pavement replaced for three years. Respectfully submitted.

E. A. FISHER,
Chairman of Committee on Street Paving.

WATER RATES IN THE LARGER CITIES OF THE UNITED STATES.

By August Herrmann, Commissioner of Water-Works, Cincinnati, O.

The question of the amount charged for water is an important one in every city. It is very often the case that officials having the management of water departments are unnecessarily and unintelligently criticised for the reason that the water rates of their respective cities are so much higher than those of other cities to which a comparison has been made. As a rule these criticisms are made by those who have not closely examined into the conditions bearing on this subject in the various cities, simply taking as an argument the prices charged per 100 cubic feet of water in one city as compared with that of another city, or some like basis of calculation, and then charging mismanagement on the part of the department having the high rate. Such a claim is ridiculous. In making comparisons all of the conditions of the department must be taken into consideration, the source of supply, the manner of pumping and repumping the water, the discount on the water bills, the charges against the water fund, and such other matters as would necessarily affect the cost of operation and maintenance.

In gathering the data for this paper it was deemed advisable to secure not only the water rates charged in the different cities, but general statistics that might have a bearing on this subject. As was done last year, the information to be obtained was confined to cities that had a population of 80,000 or more at the last United States census, excepting therefrom the city of Washington, D. C., alone, believing that the conditions existing there were so different from those in other cities that an intelligent comparison could not be made. Of the thirty-one cities in the country coming under that heading data has been obtained from all of them excepting the cities of Wrocester, Mass., Denver, Col., and San Francisco, Cal.

In some of the cities water rates are enumerated under no less than several hundred items. It would be almost impossible to prepare a table showing these different enumerations and comparisons. However, all of the data obtained will be preserved, and should any of the members of the society desire information on any particular item of charge the same will be furnished on application.

I will present first several tables showing the rates charged for water, taking as a basis the principal items of revenue of water departments. The first table shows the rate charged for water furnished through meters which, in most instances, is the largest single item of revenue in water departments. In some of the cities water is furnished through meters, giving a price per 100 or 1,000 gallons; in others per 100 or 1,000 cubic feet. The table shows the rate computed on basis of charge per 100 cubic feet, and is as follows:

Rates charged for water furnished through meters. Prices computed on basis of charge per 100 cubic feet.

NAME OF CITY.	Rate per 100 cubic feet.	Remarks. Graduated according to consumption. Minimum Rate.
Detroit, Mich	1.17 to 3.74 cents	50 cents per month
Buffalo, N. Y.	1.50 to 4.49 cents	$24 per annum.
Toledo, O.	2.62 to 7.48 cents	$6 to $10 per annum.
Chicago, Ill.	2.94 to 7.48 cents	
Kansas City, Mo.	2.99 to 23.19 cents	
Philadelphia, Pa.	3.00 cents	
Syracuse, N. Y.	3.50 to 14.00 cents	
Cleveland, O.	4.00 cents	
Albany, N. Y.	4.49 cents	
Louisville, Ky.	4.49 to 11.22 cents	700 gallons daily or less, 10 cents.
Baltimore, Md.	4.50 cents	
Milwaukee, Wis.	4.50 cents	$1 per annum for reading meter.
Columbus, O.	4.50 cents	
St. Paul, Minn.	5.00 to 10.00 cents	
Indianapolis, Ind.	5.24 to 14.96 cents	(Also a reduction of 1 mill for each 1,000 (ft. in excess of 5,000 ft. per month down to (a minimum charge of 3.37c per 100 cubic ft.
Minneapolis, Minn.	5.98 cents	
Pittsburg, Pa.	5.98 to 14.96 cents	
Nashville, Tenn.	6.00 to 15.00 cents	
Cincinnati, O.	6.50 to 8.00 cents	
Newark, N. J.	6.53 to 11.50 cents	
Allegheny, Pa.	7.48 cents	
Rochester, N. Y.	7.48 to 10.47 cents	$5 per annum.
St. Louis, Mo.	7.48 to 22.44 cents	
Omaha, Neb.	7.48 to 26.18 cents	
Brooklyn, N. Y.	7.50 cents	
Jersey City, N. J.	7.50 to 13.50 cents	
Boston, Mass	8.00 to 14.00 cents	$15 per annum.
New York, N. Y.	10.00 cents	
Providence, R. I.	11.22 to 14.96 cents	
New Orleans	11.22 to 26.18 cents	(A special rate is made where the con- (sumption is over 10,000 gallons daily.

From this table it will be seen that, of the thirty cities enumerated, twenty have a graduated meter rate, according to the amount of water consumed, while ten have a straight rate. The lowest graduated rate is in Detroit, being 1.17 to 3.74 cents; Buffalo coming next, 1.50 to 4.49 cents per 100 cubic feet, while New Orleans has the highest rate, being 11.22 to 26.18 cents. The lowest straight rate is 3 cents, at Philadelphia, Pa., and the highest straight rate is New York, boroughs of Manhattan and Bronx.

Another big item of revenue of water departments is that received from dwelling houses. As has already been stated, it is almost impossible to take up all of the items for comparison. The next table shows the rates charged for a six-room dwelling house occupied by one family, containing attic and basement, lot, say from 18 to 20 feet front, two stories high, having the following privileges: One yard hydrant, one kitchen sink, one stationary washstand; one bath, hot and cold water; one self-closing closet, one two-tray laundry, and sprinkling 50 square yards of lawn.

The table is as follows:

SIX-ROOM DWELLING-HOUSE.

Where blank spaces appear, there are no extra charges for those fixtures the same being included in the first charge for the house.

NAME OF CITY.	6-Room House as described.	1 Yard Hydrant.	1 Kitchen Sink.	1 Stationary Wash Stand.	1 Bath Hot and Cold Water.	1 Self-Closing Water Closet.	1 2-Tray Laundry Tub.	Sprinkling 50 sq. yds. Lawn.	Total.
Detroit, Mich	$ 2 00	.....	.....	$ 50	$ 1 00	$ 1 60	.....	$ 60	$ 5 70
New York, M. Bx. (1)	7 00	.....	.....	.....	.....	.....	.....	Phib'd	7 00
Cleveland, O	4 50	.....	.....	.....	2 00	2 00	.....	.....	8 50
Chicago, Ill. (2)	7 00	.....	.....	.....	.....	.....	.....	2 00	9 00
St. Paul, Minn	3 80	.....	.....	.....	2 00	2 00	.....	1 50	9 30
Buffalo, N. Y. (3)	3 50	.....	.....	.....	1 00	1 50	.....	2 25	9 75
Minneapolis, Minn	1 80	.....	.....	50	2 00	2 50	.....	3 00	9 80
Brooklyn, N. Y. (4)	8 00	.....	.....	.....	.....	.....	.....	2 50	10 50
Baltimore, Md. (5)	12 00	.....	.....	.....	.....	.....	.....	.....	12 00
Cincinnati, O	5 20	.....	.....	90	2 70	1 50	1 00	1 00	12 30
Rochester, N. Y. (6)	.....	.....	.....	.....	2 00	2 00	.....	4 00	13 00
Louisville, Ky	6 00	.....	.....	50	2 50	3 00	1 00	1 00	14 00
Indianapolis, Ind	5 00	.....	.....	.....	3 00	3 00	.....	4 00	15 00
Toledo, O	5 00	.....	.....	1 00	3 00	3 00	2 00	1 00	15 00
Columbus, O	3 98	.....	.....	.....	2 66	2 00	3 33	3 33	15 30
Milwaukee, Wis. (7)	6 00	.....	.....	1 00	3 00	2 00	2 00	2 50	16 50
Newark, N. J. (8)	6 25	.....	.....	.....	5 00	2 50	.....	3 00	16 75
Kansas City, Mo	5 50	.....	.....	.....	4 25	4 00	.....	3 20	16 95
Pittsburg, Pa	7 00	.....	1 00	.....	1 00	3 00	.....	5 00	17 00
Albany, N. Y. (9)	12 00	.....	.....	.....	.....	.....	.....	5 00	17 00
Jersey City, N. J. (10)	10 45	.....	.....	.....	4 00	3 00	.....	.....	17 45
Boston, Mass. (11)	.....	.....	.....	.....	.....	5 00	.....	5 00	18 00
St. Louis, Mo	6 00	.....	.....	.....	5 00	5 00	.....	2 50	18 50
Philadelphia, Pa	5 00	.....	.....	.....	3 00	1 00	5 00	5 00	19 00
Allegheny, Pa. (12)	10 25	.....	.....	1 50	3 00	2 00	.....	2 50	19 25
Syracuse, N. Y.	5 00	.....	.....	.....	4 00	5 00	.....	6 00	20 00
Omaha, Neb	6 75	.....	.....	1 00	3 50	2 50	2 00	5 00	20 75
Nashville, Tenn. (13)	6 00	.....	.....	.....	8 00	6 00	.....	1 50	21 50
Providence, R. I.	6 00	.....	.....	2 00	5 00	5 00	3 00	5 00	26 00
New Orleans, La	11 00	.....	4 00	2 50	3 75	6 00	4 50	.....	31 75

(1) New York—Approximated on frontage rates, two-story building, 20 feet front.

(2) Chicago, Ill.—Approximated on frontage rates, two-story building, 20 feet front.

(3) Buffalo, N. Y.—Approximated on frontage, two-story building, 20 feet front; also an excess rate of $1.50.

(4) Brooklyn, N. Y.—Approximated on frontage rates, two-story building, 20 feet front.

(5) Baltimore, Md.—Approximated on frontage rates, two-story building, 20 feet front.

(9) Albany, N. Y.—Approximated frontage rates, two-story building, 20 feet front.

(10) Jersey City, N. J.—Approximated on frontage rates, two-story building, 20 feet front.

(7) Milwaukee, Wis.—The rates charged in Milwaukee, under surveys, entitle the consumer to a fixed amount of water only.

(8) Newark, N. J.—In addition to dwelling house charge and special charge, as shown, there is also a charge of $1.25 for kitchen boiler.

(6) Rochester, N. Y.—Dwelling houses assessed according to valuation. A house whose assessed valuation is $1,500 or less is assessed at $4. It is then graduated up to $7.50, according to valuation.

(11) Boston, Mass.—According to value of building. Estimated value of building at $3,000 assessed at $8. Dwelling houses assessed according to valuation. A house valued at $1,000 is assessed at $6 per annum. This rate is increased for each $1,000 or part thereof $1 per year.

(12) Allegheny, Pa.—Closet and sprinkling rates are figured at minimum prices.

(13) Nashville, Tenn.—This rate is for three persons or less, each additional person $2.00.

From this table it will be seen that for

this kind of a dwelling house Detroit has the lowest rate, viz.—$3.70 per annum, New York (boroughs of Manhattan and Bronx) coming next at $7 per annum. The highest rate is at New Orleans—$31.75 per annum. The average rate is $15.42, fifteen cities being below and fifteen cities above the average.

The next table shows the rates for a larger dwelling house, viz.: A twelve-room house occupied by one family, containing attic and basement, lot, say from 50 to 60 feet front, three stories high, having the following privileges: One yard hydrant, one kitchen sink, three stationery washstands, two baths—hot and cold water, three self-closing closets and sprinkling 150 square yards of lawn.

This table is as follows:

TWELVE-ROOM DWELLING-HOUSE.

When blank spaces appear there are no extra charges for those fixtures, the same being included in the first charge for the house.

NAME OF CITY.	12-Room House as Described.	1 Yard Hydrant.	1 Kitchen Sink.	3 Stationary Wash Stands.	2 Baths, Hot and Cold Water.	3 Self-Closing Water Closets.	1 ¾-Tray Laundry Tub.	Sprinkling 150 sq. yds. Lawn.	Total.
Baltimore, Md. (1)	$ 13 00								$ 13 00
Detroit, Mich	2 00			$ 6 00	$ 1 60	$ 2 80		80	13 20
Cleveland, O	7 50				4 00	6 00			17 50
Rochester, N. Y. (2)					3 00	4 00		4 00	17 50
St. Paul, Minn	5 60				3 50	6 00		3 00	18 10
Buffalo, N. Y. (3)	8 00				2 00	3 50		4 25	19 25
Minneapolis, Minn	3 60			1 50	4 00	7 50		3 00	19 60
Syracuse, N. Y	5 00				4 00	7 00		6 00	22 00
New York City (4)	16 00				3 00	4 00		P'hib'd	23 00
Columbus, O	7 28				3 99	4 66	3 33	4 35	23 61
Newark, N. J	6 25				7 75	5 00		5 00	24 00
Toledo, O	5 00			3 00	5 00	7 00	3 00	2 00	25 00
Cincinnati, O	8 50			2 70	5 40	4 50	1 50	3 00	25 60
Philadelphia, Pa	5 00			2 00	6 00	3 00	5 00	5 00	26 00
Louisville, Ky	9 50			1 50	5 00	9 00	1 50	1 00	27 50
Brooklyn, N. Y. (7)	19 00				3 00	4 00		2 50	28 50
Chicago, Ill. (6)	16 50			2 00	3 00	6 00		3 00	30 50
Pittsburg, Pa	13 00		$ 1 00	2 00	2 00	9 00		5 00	32 00
Boston, Mass						15 00		5 00	32 00
Indianapolis, Ind	12 00				6 00	9 00	7 00		34 00
Albany, N. Y. (9)	22 50				3 00	4 00		5 00	34 50
Milwaukee, Wis	12 00			3 00	6 00	6 00	3 00	5 00	35 00
Omaha, Neb	11 25			3 00	5 50	7 50	3 00	5 00	35 25
Allegheny, Pa. (11)	19 25			4 50	6 00	4 00		2 50	36 25
Providence, R. I	6 00			4 00	8 00	11 00	3 00	5 00	37 00
Kansas City, Mo	9 25				8 50	12 00		8 00	37 75
Jersey City, N. J. (12)	22 50				8 00	9 00			39 50
St. Louis, Mo	9 00				10 00	15 00		7 50	41 50
Nashville, Tenn. (13)	6 00				16 00	18 00		4 50	44 50
New Orleans, La	15 00		4 00	6 50	8 25	14 00	4 50		52 25

(1) Baltimore, Md.—Approximated on frontage rate, three-story building, 50 feet front.

(2) Rochester, N. Y.—According to value of building, estimated value of building $7,000, assessed at $650.

(3) Buffalo, N. Y.—Approximated on frontage rate, three-story building, 50 feet front.

(4) New York (Manhattan)—Approximated on frontage rate, three-story building, 50 feet front.

(6) Chicago, Ill.—Approximated on frontage rate, three-story building, 50 feet front.

(7) Brooklyn, N. Y.—Approximated on frontage rate, three-story building, 50 feet front.

(9) Albany, N. Y.—Approximated on frontage rate, three-story building, 50 feet front.

(12) Jersey City, N. J.—Approximated on frontage rate, three-story building, 50 feet front.

(2) Rochester, N. Y.—Dwelling houses assessed according to valuation, $865.36, $28.84½ average of house, a house whose assessed valuation is $15,000 or less is assessed at $4.00. It is then graduated up to $7.50, according to valuation.

(5) Newark, N. J.—In addition to dwelling house, charge and special charges as shown, there is also a charge of $1.25 for kitchen boiler.

(8) Boston, Mass.—According to value of building; estimated value of building $7,(0), assessed $12.00. Valued at $1,000 is assessed at $6.00 per annum. This rate is increased for each $1,000 or part thereof $1.00 per year.

(10) Milwaukee, Wis.—The rates charged in Milwaukee under surveys entitle the consumer to a fixed amount of water only.

(11) Allegheny, Pa.—Closet and sprinkling rates are figured at minimum prices.

(13) Nashville, Tenn.—This rate is for three persons or less, each additional person $2.00.

From this table it will be seen that for this kind of a dwelling house, Baltimore has the lowest rate, viz: $13 per annum; Detroit next, $13.20 per annum. The highest rate is at New Orleans, $52.25 per annum. The average rate is $28.84, sixteen cities being below, and fourteen cities above the average.

This table, in order to be fully understood, must be carefully analyzed. Taking dwelling houses as an entirety, it is evident that Detroit has the lowest rate, there being a uniform charge of $2 per annum for one family, regardless of the number of rooms, while additional families are charged for at the rate of $1 per annum. Philadelphia comes next, having a uniform rate of $6 per annum, regardless of number of rooms, or families in the building. Minneapolis, Cleveland, Columbus and Toledo also have very low rates. The highest rate of all the cities is New Orleans, La.

The charges for each additional room in a house having over sixteen rooms run from 30 cents per room per annum in Cincinnati, Minneapolis and St. Paul to $1.50 per room per annum in Allegheny. A number of cities make no charge for extra rooms. Eight cities charge nothing for additional families over one. In the other twenty-two cities the additional family charge runs from $1 per annum per family in Detroit to $8 per family in Nashville.

Chicago, Baltimore, Albany, Kansas City and Brooklyn make no charge for the first bath, closet, wash stand, etc., in addition to the dwelling house rate, while the other twenty-five cities have special charges for these privileges, in addition to the dwelling house rates.

The next table shows the charges, where same are made, for baths, closets, wash-stands and laundry tubs in private dwellings and is as follows:

FIXTURES IN DWELLING-HOUSES, PER ANNUM.

Where blank spaces are shown, no charges are made, the same being included in dwelling-house rate.

NAME OF CITY.	Closets (One).	Baths—Hot and Cold (One).	Stationary Wash-stands (One).	Laundry (Tray Each.)
Cincinnati	$1 50	$2 70	$ 90	$ 50
Milwaukee, Wis.	2 00	3 00	1 00	1 00
Nashville, Tenn.	6 00	8 00	.....	.....
Cleveland, O.	2 00	2 00	.....	.....
Columbus, O.	2 00	2 66	.....	3 33
Newark, N. J.	2 50	5 00	.....	.....
Jersey City, N. J.	3 00	4 00	.....	.....
Detroit, Mich.	1 60	1 00	.....	.....
Allegheny, Pa.	2 00	3 00	1 50	.....
Omaha, Neb.	2 50	3 50	1 00	1 00
Toledo, O.	3 00	3 00	1 00	1 00
Syracuse, N. Y.	5 00	4 00	.....	.....
Louisville, Ky.	3 00	2 50	50	50
St. Louis, Mo.	5 00	5 00	.....	.....
Rochester, N. Y.	2 00	2 00	.....	.....
Buffalo, N. Y.	1 50	1 00	.....	.....
Providence, R. I.	5 00	5 00	2 00	3 00
Pittsburg, Pa.	3 00	1 00	1 00	.....
Indianapolis, Ind.	3 00	3 00	.....	.....
Boston, Mass.	5 00	.....	.....	.....
New Orleans, La.	6 00	3 75	2 50	4 50
Minneapolis, Minn.	2 50	2 00	50	.....
St. Paul, Minn.	2 00	2 00	.....	.....
Philadelphia, Pa.	1 00	3 00	1 00	5 00
Kansas City, Mo.	4 00	4 25	.....	.....

Chicago, Ill.—No charge for first closet or bath, including in house charge.

Albany, N. Y.—No charge for first closet or bath, including in house charge.

Brooklyn, N. Y.—No charge for first closet or bath, including in house charge.

New York, N. Y.—No charge for first closet or bath, including in house charge.

Baltimore, Md.—No charge for first closet or bath, including in house charge.

From this table it will be seen that five cities make no charge at all for these privileges, the same being in the dwelling house rate. The lowest charge for closets for domestic purposes is in Philadelphia, the same being $1 per annum. The highest is in Nashville and New Orleans, being $6 in each of these cities. For baths, the lowest charge is $1, in Detroit, Buffalo and Pittsburg, while the highest charge is $8, in Nashville. Twenty cities have no extra charge for stationary wash-stands in addition to the dwelling house charges, while of the remaining ten, Louisville and Minneapolis charge 50 cents each per annum, which is

AUG. HERRMANN,
Commissioner of Water-Works, Cincinnati, O.

the lowest, while New Orleans charges $2.50, which is the highest. Twenty-one cities have no extra charge for laundry tubs, in addition to the dwelling house charges, while of the remaining nine, Cincinnati and Louisville charge 50 cents per annum per tray, which is the lowest, and Philadelphia charges $5 per annum, regardless of number of trays, which is the highest.

Next is presented a short statement showing the charges for stores and business premises, which is as follows:

Stores and Business Premises, per annum.

—Where no Meters are Attached—

Cincinnati, O.—Each place occupied wholly or in part as a store, office, shop, warehouse, or business of any kind, 500 square feet, or less, $1 per annum. This price includes only one sink. Fixtures such as closets, urinals, wash-stands, etc., are additional charges, according to number of people and kind of business.

Milwaukee, Wis.—Stores and business premises are charged according to the business transacted and number of persons employed. The rates fixed are for general uses only, and do not include the use of water for special purposes.

Nashville, Tenn.—Stores and business premises are charged according to the business transacted and the number of persons employed. Closets and baths are charged for in addition to regular fixed charges for premises.

Cleveland, O. — Stores and business premises, 20 feet front or less, $3 per annum; 20 feet to 33 feet, $5 per annum; 33 feet to 66 feet, $8 per annum; over 66 feet, $10 per annnum. Closets and baths extra.

Columbus, O.—Stores, according to location, 20 feet front or less, $2 per annum; 20 to 30 feet, $4 per annum. Each additional foot front over 30 feet, 10 cents. Extra charge for special privileges.

Newark, N. J.—Stores are charged for according to business and number of persons employed. Special fixtures extra.

Jersey City, N. J.—According to the number of feet front and height of building. Special fixtures extra.

Detriot, Mich.—From $1.20 to $12 per annum.

Allegheny, Pa.—Store rooms, from $2.50 to $10. Special fixtures extra.

Chicago, Ill.—Stores are asesssed in addition to frontage rates, 25 cents per annum for each person employed therein, exceeding ten; also, additional charge for special fixtures.

Omaha, Neb.—Stores are assessed from $5 to $15 each per annum. Special fixtures extra.

Syracuse, N. Y.—Stores $10 per annum. All fixtures outside of one faucet are charged axtra.

Buffalo, N. Y.—Stores in addition to specific rates, $1.50 per annum and upwards.

Toledo, O.—According to number of feet front, business engaged in, number of persons employed, etc. Special fixtures extra.

Brooklyn, N. Y.—According to frontage. Extra for certain business and fixtures.

Louisville, Ky.—A minimum and maximum rate is fixed, dependent entirely upon the business engaged in. Separate charges for fixtures.

St. Louis, Mo.—According to business engaged in. Special fixtures extra.

Albany, N. Y.—Stores are assessed at two-thirds of frontage rates. See dweling house charges.

Philadelphia, Pa.—Stores are assessed according to business. Special features are charged extra.

Baltimore, Md.—Stores are assessed according to feet front, running from $6 to $10 per annum. Nothing extra for fixtures.

Pittsburg, Pa.—All charges according to fixtures in use.

Boston, Mass.—The rate for stores, etc., is determined by the number of persons employed or doing business, the charge for ten or less being $5 per annum. Special fixtures are charged extra.

New York—Frontage rates in force here.

New Orleans, La.—From $8 to $20 per annum.

Providence, R. I.—Charges for stores are the same as dwelling house fixture charges.

Indianapolis, Ind.—According to number of feet, front, running from $5 to $15 per annum.

Rochester, N. Y.—From $5 to $30, according to business.

Minneapolis, Minn.—Stores for sale of any goods, except liquors and dry goods, $4. Special fixtures extra.

St. Paul, Minn.—Stores are assessed according to width. Extra charges for special fixtures.

Kansas City, Mo.—Stores from $4.25 to $17 per annum. Special fixtures extra.

From this table it will be seen that for building purposes Detroit has the lowest rate and New Orleans the highest.

These tables, in my judgment, give a general idea of what the water rates are in the various cities. Taken as an entirety, it is evident that Detroit has the lowest rate and New Orleans the highest.

Before passing from this feature of the paper I desire to call your attention to a

RATES FOR BUILDING PURPOSES.

NAME OF CITY.	Brick per 1000.	Plastering per 100 sq. yds.	Stone per Perch.
Cincinnati, O	$0 10	$0 20	$0 4
Milwaukee, Wis	6	30	2½
*Nashville, Tenn	.....	.....	.....
Cleveland, O	10	30	5
**Newark, N. J.	10	35	2½
Jersey City, N. J.	10	.....	2
Detroit, Mich	2	5	0½
Chicago, Ill	5	15	1
Omaha, Neb	7	15	.....
Toledo, O	4	15	5
Syracuse, N. Y.	6	20	2
Louisville, Ky	10	.....	4
Rochester, N. Y.	10	50	4
Albany, N. Y.	6	.....	.....
!Buffalo, N. Y.	5	20	1 1-3
Brooklyn, N. Y.	5	20	1 1-3
St. Louis, Mo.	10	50	5
Pittsburg, Pa	10	50	5
!!Indianapolis, Ind	10	35	3
Boston, Mass	6½	10½	2¾
New York, N. Y.	10	40	.....
New Orleans, La.	25	1 00	.....
Minneapolis, Minn	5	20	1½
St. Paul, Minn.	5	20	1½
Kansas City	8½	33 1-3	2½

*No fixed charges here. Stone masons and brick masons are charged from $20 to $60 per yard.

**Per cubic yard.

!Per cord.

!!Per yard.

clause in the Brooooklyn scale of water rents charged against "vacant lots," which is as follows:

"Vacant lots $100 and under, 1 cent per running foot frontage.

"Assessed at over $100 and not over $200, 2 cents.

"Assessed at over $200 and not over $500, 5 cents.

"Assessed at over $500 and not over $1,000, 10 cents.

"Assessed at over $1,000 and not over $2,000, 15 cents.

"Assessed at $2,000 and over ——, 20 cents."

I do not find a charge of this kind in any of the other cities, excepting Albany, N. Y., where a charge is made of 10 cents per annum per front foot. As to the advisability of assessing vacant property, I have nothing to say. However, a clause of this kind, strictly enforced, would no doubt realize a neat sum in almost any city, probably sufficient to justify a reduction in the rates as now existing.

It is important that the members of the society examine the figures shown in the tables presented, in so far as they pertain to their respective cities, so that if any of the figures are wrong the same may be corrected before sending the copy to the printer.

I come now to the other feature of this paper. As I have already stated, in addition to securing the rates charged in these cities, it was deemed advisable to also secure data that may have a bearing on the subject of fixing rates. A series of questions were pre-

pared and submitted to the officers of the various cities as follows:

Question 1. Do you have a gravity supply, or are you required to pump all your water?

Question 2. In furnishing water to your citizens, do you pump directly into the supply pipes, or do you pump into reservoirs, standpipes, tanks or towers?

Question 3. What is the pressure of water in your pump mains, and what is your suction lift?

Question 4. If you have a high service, what is the pressure in your pump main, and what is your suction lift, and what is the proportion of the water pumped by the high service to the total supply?

Question 5. What is your source of supply?

Question 6. Do you purify your water supply? If so, what is the cost of purification as compared with the entire cost?

Question 7. Are main pipe extensions paid for out of revenue of water department, or by assessment against abutting property?

Question 8. Is interest and sinking fund on existing bonded debt provided out of water rents or by general taxation?

Question 9. What discount, if any, is allowed for prompt payment of water bills?

Question 10. Is the department self-sustaining at present? Is any money raised by taxation to maintain it?

Question 11. Are the water works owned by the city or private individuals?

The answers received to these questions have been tabulated and are presented with this report. Only a careful examination of all of the details will demonstrate what value the same may have in determining by comparison the water rates in the various cities. I shall not attempt to discuss this feature of the paper in detail, but simply give a summary of the data collected in order that the members may more fully understand the importance thereof.

Of the thirty cities enumerated twenty-one are required to pump all of their water; four receive the same by gravity, viz.: Newark, Jersey City, New York and Syracuse, while five cities receive part by gravity and are required to pump part of it. Two of the cities do not do any pumping at all, the gravity supply being sufficient for distribution; ten pump into reservoirs; seven into supply pipes direct, and eleven partly direct and partly to reservoirs, standpipes, etc. The importance of carefully analyzing tnis question in making comparisons of water rates should not be underestimated.

The fourth question relates to high services, the pressure in pump mains and suction lift, and the proportion of the water pumped by the high service to the total supply. As with the third question, it is better to study this answer, with respect to the pressure and suction lift, than to try to discuss it. Of the thirty cities, seventeen have a high service, while thirteen are not required to repump any part of their water. The percentage of water repumped to the total supply runs from 1.9 in Philadelphia to 23¼ per cent. in Cincinnati.

Nineteen of the cities make no attempt at purification, some of them contending that it is not necessary, and six are now taking steps toward purification. Five of them purify their water.

Twenty of the cities pay for the extension of their water mains out of the revenues of the water department; three by assessment against abutting property, and eight by assessing part and paying part out of revenues, or by general taxation.

Nineteen cities provide for both their interest and sinking fund charges out of the revenues of the department; four provide for the same, partly out of the revenues and partly by taxation, while five provide for the same by general taxation.

It is evident that if a water department was not required to pay for main pipe extensions and interest and sinking fund out of its revenues, a material reduction could be made in water rents. As has already been stated, the tables show that Detroit has the lowest rate. In that city, however, the interest charges of the department, amounting to $75,000 per annum, are provided for by general taxation. If the department was required to raise that much more money each year, it would necessarily follow that there would be an increase in the water rents.

Another important feature is the discount allowed on water bills. Nine cities allow a discount for prompt poyment, the same running as high as 20 per cent. in the city of Louisville, which, if taken into consideration, very materially affects their rate, as shown by the tables. Twenty-one of the cities allow no discount, and of this number, six exact a penalty if bills are not paid promptly.

All of the answers received as to whether or not the departments are self-sustaining, are answered in the affirmative.

Of the thirty cities the water works of only three of them are owned by private companies, viz: Those of Indianapolis, New Orleans and Omaha. The Louisville department is managed by a private company, but nearly all of the stock is owned by the city sinking fund.

ELECTROLYSIS—FROM THE STANDPOINT OF THE MUNICIPAL ELECTRICIAN.

By H. S. Wynkoop, M. E., Brooklyn, N. Y.

It almost seems necessary at the present day to offer an apology for the presentation of a paper on electrolysis—especially if the writer comes before a technical or semi-technical assemblage, leaving his maps and remedies behind. Partly to introduce variety, largely to bring forward a somewhat neglected aspect of the situation, it has seemed preferable to present the subject to you from the standpoint of the municipal electrician, rather than from that of the electrical engineer.

In Brooklyn the conditions are very complex. There are some six hundred miles of single track, six railway power houses well distributed, and a daily average of a little less than 1,900 cars in operation, including the motor cars of the elevated systems. Underground are gas and water pipes, railway tracks, Edison tube, cement-lined iron subway ducts, unoccupied, earthenware subways containing lead covered cables, supplementary wires and bundles of old rails used as ground returns. In addition, the elevated structure itself is being made the equivalent of a ground return, through its bond connections with the track it supports. All of these conductors are jumbled together, forming an irregular network through which the stray electricity is dodging hither and thither. To increase the complication, intentional connections between dissimilar conductors have been made from time to time, at the instance of experts retained by one or another of the corporations.

In earlier days the most generally accepted method of dealing with electrolysis involved the attaching of a bond wire to the damaged spot in order to conduct away harmlessly the electricity that was causing the trouble. By means of these bonds the various corporations are caring, in specific instances, for stray currents in amounts ranging from 20 to 80 amperes.

Each corporation has its own expert watching developments, and applies its own remedies, regardless of the effect upon its neighbors of the disturbance of the electrical equilibrium thus occasioned.

The former board of commissioners of electrical subways did much pioneer work, both in identifying the cause of the trouble and in suggesting remedies. This was a state institution, however, and was at times at variance with the city authorities; so that the failure of Brooklyn to obtain relief cannot be blamed upon the commission.

The water supply department occupies a peculiar position. Since 1896 it has merely awaited developments. Tests made during that year gave indications that cast iron mains were reasonably safe. Careful examination was then made of the pipes at the so-called danger points and resulted in an utter failure to detect any evidence of electrolysis. Since that time no instance of damage to the city's cast iron pipes has gone on record. Nor has any damage occurred to the cast iron of the Brooklyn Union Gas company, a corporation controlling nearly all of the gas mains in Brooklyn. On the other hand, the Edison Electric Illuminating company exhibits a cast iron coupling box badly corroded, electrolytically, on one side. This last cast iron was markedly different, in the appearance of its fracture, from the various samples of pipe presented.

As it is in Brooklyn, so it is in other communities. In reading the reports of experts on electrolysis one is at once struck with the one-sidedness of the evidence. The subject is almost invariably treated piecemeal; either in its relation to the gas system, or to the water pipes, or to cable coverings, or to the street railway. Perhaps it is no exaggeration to say that to not one of these reports could properly be applied the title, "Electrolysis in its Relation to the Public Interests to the Town of Blank."

To the writer these reports, while valuable statistically, appear to involve an uneconomical expenditure of brain energy. They cover the same ground again and again, and offer partial solutions, applicable at the best to only a few of the interests affected, without in any degree comprehending in their scope the grand problem that confronts the municipality.

What part, then, does the municipality bear in relation to electrolysis? It is responsible, primarily and finally, alike for the existence of the problem and for the securing of its solution—responsible, morally, because it originally approved, by franchise, of the single overhead trolley; responsible, legally, because the public interests are jeopardized, and the safeguarding of such interests is a function of the municipality; responsible, practically, because it is generally the only body exercising authority over all of the private corporations operating within its boundaries.

How much is being done by the municipality in the way of living up to its responsibility? Generally speaking, the situation may best be summed up by quoting four stereotyped answers to complaints, these answers being much employed by city authorities everywhere:

First, to the private citizen: "O, yes, we have had a number of complaints lately

about the failure of water services. If you will go to the office of the street railway and state your case, the company will, in all probability, pay your plumber's bill. There is no doubt but that the railway is responsible."

Second, to the private corporation: "Your corporation, as a very heavy taxpayer, is undoubtedly entitled to protection. However, we do not know as yet how to protect you. The railway people have suggested remedies that we cannnot adopt without falling into legal entanglements, while several electrical men have endeavored to scare us into purchasing their patented systems or appliances. If you will engage an electrical engineer we will assist you in every way in puttting his recommendations into effect."

Third, to the water department authorities: "The city holds a twenty-five-thousand-dollar indemnity bond of the street railway, and that sum will cover any damage that we are likely to sustain for any years."

Fourth, to the various electrical interests: "We are laymen. We do not know anything about this. It would seem that you electrical people ought to be able to correct these little troubles among yourselves."

So long as this shifting of the burden from back to back remains in vogue, it is hardly to be expected that any great advance will be made. We ought not longer to deal so frivolously with a question involving not merely the safety of buried pipes and wires, but as well the entire matter of municipal rapid transit. If the remedy for electrolysis does not come the single overhead trolley will have to go.

And in the place of the single overhead trolley, what? A complicated double overhead trolley; an expensive underground trolley; an experimental storage battery system; compressed air motors. The abolishment of the single trolley is a dread alternative, not to be considered seriously until a rival to the single trolley in the transportation field has been discovered.

Granting, then, that most of us find ourselves face to face with a living municipal problem, how is it to be handled? Since it is hardly possible to combine in any one man the attributes of the expert chemist, the expert electrical engineer and the expert lawyer, the institution of a special commission is suggested. Thus, in addition to the advantage of having a number of trained minds working concentratedly upon the problem, an opportunity of technical representation on the commission is afforded to each of the affected interests. In view of the many-sidedness of the subject, a board of nine members seems not unreasonable; and the representation might properly include water, gas, electric lighting and power, electric signalling, subways, the electric railway. The electrical bureau, if there be one, of the city, should be represented; otherwise, the commission will find it necessary to obtain the services of a consulting electrical engineer. A chemist of reputation must not be forgotten. Chemistry is to play a larger part, apparently, in effecting the final solution than most of us realize. Legal questions, also, will from time to time come to the surface; and to answer them a member of the legal fraternity might be added very profitably to our commission.

Kindly, pardon, at this point, a digression in favor of the electric railway company. The writer's experience is, that in every instance where the trolley people have been approached in a spirit of equity they have invariably come at least half way in return. Indeed, it has been necessary to officially curb their zeal in Brooklyn, by refusing permission for the attachments of bonds to water mains. We feared that such permission would render the city jointly liable with the railway for all damages to service pipes, past, present and future. Whether this was a sound legal argument or not, it was undoubtedly a fortunate expression of policy; for the claim was actually made by a disgruntled house owner, shortly after this refusal, that "he didn't care nothin' about the trolley; his electricity came off the water mains along with the water, and the city hadn't any right to hook wires on the water pipes and the tracks and damage poor people to help big corporations"—alluding to an instance whe.e such bond connection had been tentatively applied a year or two before.

As far as Brooklyn's service pipes are concerned that borough is probably no better off than is any other city. Some of the expedients resorted to in order to secure relief are ridiculous, while thoroughly effective. In one case the pipe has been carried overhead across the street, thus avoiding any near approach to the rails. In other instances heavy rubber hose has been slipped over the lead service pipes in localities where much electrolytic trouble has been experienced. Don't laugh; it is surprising how long the rubber will last; and, of course, the pipe is safe during the lifetime of the hose.

The wrought iron and steel services of the gas system are attacked also, and the company is suffering from an abnormal leakage of gas.

Telephone cables appear to be reasonably safe, but the electric light cables are in an unsatisfactory condition. Edison tube is suffering greatly in some places.

Coming down to cast iron, we find an interesting situation. The water mains are as yet unharmed, and so are the gas mains. This is in direct contrast with the state of affairs at Dayton, O., as reported by Mr. Harold P. Brown in his valuable paper of last year. Now, why is cast iron permanent in one city and so easily destroyed in another? Chemical accidents of soil, water

and iron, you say; but what chemical accidents? Does anybody know definitely? We, in Brooklyn, are using a very hard, dense, even-grained, white cast iron, containing alloyed rather than combined carbon and coated with some variety of asphaltic varnish. Clearly, the problem is largely a chemical one

And that it is in reality a chemical problem is coming home more closely every day. Electrical remedies have thus far failed. The improved track return is a palliative, not a cure. The inter-bonding plan results in a ceaseless disturbance of the electrical equilibrium. The auxiliary potential method is applicable only to those towns whose electrical map is comparatively simple, and few of the larger towns come within this class today. The insertion of insulating sections of pipe along the line tends to throw an increased burden upon other conductors. Finally, not one of these suggested remedies offers more than a partial and temporary relief. All of them delocalize and render latent the evidences of electrolytic decay; but to just what extent is a hard matter to determine. Our voltmeter readings are undeniably valuable; and yet, after all, they are merely resultants, so that, when accepted in their true light, they afford no absolute certainty that local action is not taking place in the immediate vicinity of the test points.

Contemplating the problem from the view point of chemistry, however, the atmosphere seems clearer. Our civilization always boasts of bullet-proof cloth, fire-proof wood and other paradoxes; why should we turn aside from the idea of electrolysis-proof steel, iron and lead? As soon as there shall have been discovered an alloy of pipe material that will not be attacked by the acids set free by electric currents in the soil, or a paint, varnish, lacquer or oxide coating that will absolutely protect the present steel, iron and lead, the solution of this latest municipal problem will have been effected.

THE LIFE OF PAVEMENTS.

By Geo. W. Tillson, M. Am. Soc. C. E., Principal Engr. Dept. of Highways, Brooklyn, N. Y.

When one seeks to purchase a new article the first question usually is what does it cost? And if it be subject to wear there immediately follows, how long will it last? And, although asked second, this latter question can hardly be said to be of secondary importance. For, while the first cost of an article may determine one's ability to buy it, it does not by any means settle its economy, for what is cheap to obtain at first is often most expensive in the end.

So when it comes to the selection of a paving material the question of durability is of the utmost importance. What is the life of a particular kind of pavement? The question is often answered off-hand by the tyro positively, and with little hesitation, but the engineer of experience who has seen a pavement last a certain time on one street, and twice as long on another, has seen the result of this condition here and another there, gives his reply hedged in by so many provisions that at first sight it would seem to be of little value. But when it is carefully studied the discovery is made that these restricting conditions are just what are required to adapt the reply to any particular case that may happen to be in point.

To the study then of the varied conditions affecting the life of a city pavement this paper will be given.

The two great agents that tend to destroy a pavement are traffic and the atmosphere. The former is variable, and its effect varies directly according to the amount applied under certain conditions. The action of the latter is constantly depending somewhat upon the climate, but principally upon the nature of the paving material.

Traffic and the atmosphere act positively and their results can be measured. At the present time it may be said that there are four materials being used in street pavements—stone, brick, asphalt and wood. The action of traffic and the atmosphere is very different upon these materials as affecting durability. It is safe to say that the life of stone and brick (taking it for granted that none of their kind of a quality to be acted on by the air would be used) in a pavement depends, other things being equal, directly on the amount of the traffic they sustain, but that statement would not be true of asphalt and wood. For should the traffic be light the life of the pavement would be ended by the action of the atmosphere—asphalt not to such an extent as wood, but it is well known that an asphalt pavement deteriorates materially under the oxidizing effect of the air, even if it have little or no traffic.

It must be remembered, also, that there are two ends to all pavements, the physical and the economic end. The former comes at a time when the pavement is so worn out that it cannot be repaired and must be entirely relaid; the latter when the cost of repairing is such that it will be cheaper to relay it entirely than to spend any money on repairs. These two ends do not necessarily come at the same time. The former test will generally be applied to stone, brick or any block pavement, and the latter to asphalt or

macadam. When a pavement is made up of moderately sized parts of practically the same character and texture, the wear on these parts is practically the same and the repairs necessary are generally relaying old material, rather than furnishing new. But when the pavement is made up of parts so small that they must be consolidated into a continuous whole before they can be available it is different.

The physical end of a pavement can be determined by observation. Blocks wear on account of abrasion and impact. Granite wears in two ways, by chipping and rounding off of the corners, and the gradual grinding off of the blocks under the friction of wheeled vehicles. When the blocks are of the harder granite or traps the former action takes place. The softer granites and the sandstones wear down smoothly with flat surfaces, and in time the blocks actually become worn out, the pavement becomes rough, horses stumble, and it is soon seen that the street should be repaved.

Asphalt and macadam wear away, and new material can be added in large or small quantities as may be desired, and the physical life of the pavement prolonged indefinitely. It is then that the economic test is applied to ascertain when the pavement should be renewed. Assume that a street is paved, but the expense of keeping it in good condition is considerable, and this question arises, shall the repairs be continued, or shall an entire new pavement be constructed?

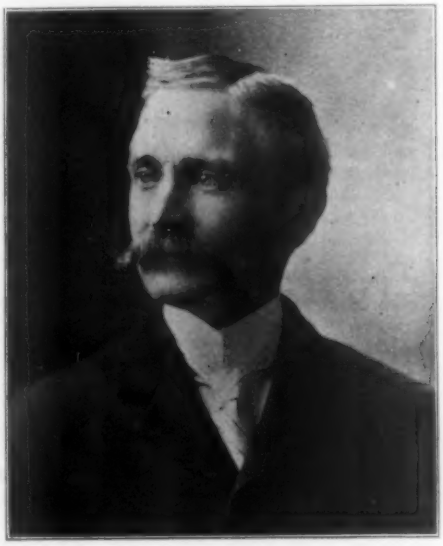
Let. N=Life of proposed pavement.
C=Cost.
I=Rate of interest.
R=Estimated cost of repairs, if distributed over entire life.
A=Sinking fund to be paid each year to equal
C at end of N years, then

$$A + CI + \frac{R}{N} = \text{Annual cost of a new pavement.}$$

Take for instance, an asphalt pavement, and let N equal 15, C equal $1.50, I equal 3½, and R equal $0.40. A will .0807, and the equation becomes .0807 plus .0525 plus .0267 equal $0.1599, or if the street be repaved it will still cost annually $0.16 until it is renewed. It must be remembered that C is equal to first cost less the value of foundation and other material at time of renewal. From the above it would seem that it is economy to repair an asphalt paved street, rather than to repave it when the cost of repairs is much less than $0.16 per yard, provided the assumption of 15 for value of N is correct, as if there is any error in the other values they must be too small rather than too large.

Let then N equal 20, other values being the same (R being obtained by taking a guarantee period of five years and assuming cost of repairs 4 cents per yard per year for remainder of life), and the equation will become .0531 plus .0525 plus .03, equal $0.1356 as the annual cost when N is taken at 20 instead of 15. The author believes that this is the engineering and the only true way of determining when an asphalt pavement should be relaid. The only element to modify this principle is the inconvenience business men and merchants may be put to by having repairs made on a street too frequently. The determination of this must be a matter of judgment to be applied in each particular case. But the principle of the formula is right and when cities have had a few years more experience with asphalt there will be no trouble in determining the true values of the variables.

Coming down to the actual conditions by which traffic is modified in its action on pavements, it will be seen that there are five, viz: Character of the pavement, width of roadway, presence or absence of street car tracks, state of repairs, and how well cleaned.



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The one great agent that acts upon a pavement is, of course, the traffic that passes over it. This is very hard to measure, and very few attempts have been made to do so in the United States. The custom has been to speak of heavy, medium and light-traffic streets, but with a very vague idea of what these terms meant, forgetting, too, that as so used they are only comparative, as medium traffic in a large city would generally be heavy traffic in a small one. Traffic has been generally measured in this city by assuming a certain weight for vehicles of different descriptions, and by counting the passage of the vehicles on a street during a given time, thus arriving approximately at the amount of tonnage passing over it. The results are generally given without regard to the width of roadway, making it very difficult to compare results

arrived at in the different cities. In England attempts have been made to reach more scientific results and the tonnage per yard of width of roadway per day or per year has been taken as the unit. This enables one to compare directly the traffic of one city with that of another, although it must be remembered that the passage of ten vehicles weighing one ton each register the same as one ten-ton truck, when it is probable that the latter would do much more damage than the former. This method, however, is probably as definite as the former.

In 1885 Gen. F. V. Greene had a series of observations taken in many of the principal streets of the leading cities of this country to determine the amount of traffic. The total number of vehicles passing between 7 a. m. and 7 p. m. was counted, the largest number being given in each case, so as to give an opportunity for comparison.

Broadway, New York	7,811
Broad-st., Philadelphia	6,081
Devonshire-st., Boston	5,362
Douglass-st., Omaha	4,752
Fifteenth-st., opposite Treasury, Washington	4,520
Clark-st., Chicago	4,389

While the author would not state that an attempt was made to get the heaviest traffic street in each case persons familiar with these cities will recognize that they are representative streets.

In Paris the vehicles passing on the following streets in twenty-four hours were:

Rue de Rivoli	42,035
Avenue l'Opera	29,500
Rue Croix des Petit Champs	20,480
Rue St. Honore	19,672
And in London:	
King William-st	26,793
Grace Church-st	15,585
Queen Victoria-st	16,531
Cheapside	15,206
George-st. in Sydney, Australia	11,960

Great Howard-st., Liverpool, sustains a traffic of 216,000 tons per yard of width per annum.

This shows very plainly that the pavements in the large European cities are subjected to much more travel than those of this country.

Width of Roadway: The distance between curbs affects traffic as it tends to scatter or congest it. If a street is to sustain a certain amount of tonnage the greater surface it can be spread over the less it will injure the pavement. This is also true when the load is reduced to a unit of width, especially if the roadway be small and the traffic continuous. In a narrow, well-traveled street the carriages and trucks move in well-defined lines, one behind the other, so that it is impossible to scatter it and subject the entire surface to anything like uniform wear. Ruts are worn in the pavement and the time comes for its renewal long before it would have could its work have been distributed evenly over it.

Character of Pavement: By this is meant the detailed method of its construction. The laying of asphalt has been practically standardized and there is not much difference in the methods of the different companies. But granite, brick and wood vary much as to foundation and joint filling. Wood, too, is often treated chemically so as to entirely do away with the climatic action and this renders it necessary to study it from the standpoint of traffic only. Different kinds of wood are used in different sections, each having a different life as a result of the physical as well as the chemical action.

To obtain the best results from a block pavement it should be laid in such a manner as to receive the traffic vertically upon the face of the blocks and so substantially that the blocks will maintain their position while in use. To accomplish this the foundation must be such as to sustain the loads liable to be imposed upon it, and the joints filled with some firm and enduring material. This is necessary for two reasons, to keep the blocks in position and to prevent water from reaching the foundation and injuring it. While the fulfilment of these conditions adds to the expense, the life of the pavement is prolonged sufficiently to more than compensate for it.

Presence or Absence of a Street Car Track: A street car track has a great bearing on the action of traffic. It concentrates travel, and in a street where the tracks are in frequent use practically reduces the roadway to the space outside the rails with all and more of the evils of a roadway of that width —more because there is almost no opportunity to get out of the regular route by using the center, which sometimes happens in a roadway without tracks as wide as the vacant space. True, such travel is accommodated on the rails, but the gauge of the heaviest trucks is greater than that of the cars, so that one wheel runs on the pavement, and being confined absolutely to the same place soon wears a rut in the hardest blocks.

In the fall of 1896 Kent-ave., Brooklyn, was paved with the best granite that comes to the New York market, on a Portland cement concrete base with tar and gravel joints. This street is probably subjected to as many heavy loads per day as any street in Greater New York, is thirty-six feet wide and has a double line of street car tracks. On one side of it are the big sugar refineries, which send daily over this pavement in their busy time some 1,000 or 1,200 loads of sugar weighing about eight tons each. It seems almost impossible for the teams to travel without the wheels of one side being in a car track. This brings those of the other side about eighteen inches from the corresponding rail. After the pavement had been thrown open to traffic for six months a rut, perhaps an eighth of an inch deep, was worn in the blocks, and on the cross walks was plainly visible. The sugar companies, who had paid one-half of the cost of the pavement, made a strong effort to

scatter the teams, sending men on the street for this especial purpose. But it was only driving the wheels from one rail to another and soon other ruts were formed, and today, after three years' service, ruts from three-quarters of an inch to one and one-half inches deep are found in several places. Contractors understand this fact and where the guarantee is required for any long period bid appreciably higher for pavements on street car streets. In 1897 bids for asphalt pavement in Brooklyn on sixty-eight streets free from tracks averaged 0.98 per square yard and $1.26 per yard on eleven streets where the tracks were present. Few cities have kept their repair account so that this extra cost can be gotten at exactly, but in an article read before this society at its last session Mr. Guthrie showed that it was $0.148 on business and .047 on residence streets with street car tracks and $0.112 on business and .048 on residence streets without tracks in the city of Buffalo for asphalt pavement.

State of Repairs: The condition in which a pavement is kept as to repairs is of vital importance. If holes, depressions or other defects are allowed to remain for any length of time the material is abnormally worn and blocks rounded off to an amount probably four or five times what they would have been had they been in their normal position. Few officials who have the maintenance of pavements in charge appreciate this, but should they examine granite blocks or bricks that have been loosely paved in a trench and allowed to remain there for some time sustaining their usual amount of travel they will surely be convinced. If this be true of the hard block pavements how much more so is it of such materials as macadam and asphalt. Watch a small hole in either of these pavements and see how rapidly it increases under traffic if it receive no attention, and how much more it costs to repair it after a few weeks of neglect, and it will be seen how rapidly neglect in this respect tends toward the economic end of any pavement, but particularly one of asphalt or macadam.

Cleanliness: At first thought it may seem that this does not have much to do with the action of traffic, but a little reflection will soon dissipate that idea. When a pavement is clean the wheels and the horses' hoofs bear distinctly on the paving material, and it must sustain the entire friction, and its reaction wears out the pavement. If, on the other hand, it be covered with a cushion of dirt, the pavement acts principally as a foundation. The author once inspected a brick pavement said to have been down five years and to be in as good condition as when laid. It was in a small town where the streets were seldom cleaned and an inch or more of street refuse had to be scraped off before the surface could be seen. An advocate of a particular brick for paving purposes in describing a pavement of it which he had recently examined, naively said, "When I dug down to it I found it just as good as it ever was."

It is said that when the Forum Trajanum was cleaned by the French in 1813 the ancient Roman pavements were found in good condition under some twelve feet of rubbish. While this is probably an extreme case, it is very likely that a modern pavement of imperishable material would have a long life under such conditions. At the last meeting of the National Brickmakers' association, when the question of how to minimize the noise of a brick pavement was being discussed, a member arose and gravely asked if our cities did not keep our streets too clean; if brick pavements would not last longer and make less noise if a cushion of dirt was allowed to remain on them. Although the question was answered in the affirmative, it was decided that officials in large cities would keep the streets clean even at the expense of brick pavements. Asphalt and wood, on the contrary, should be kept clean in order to add to their durability, as rubbish of any kind collects moisture and so hastens the decay of these two materials.

The action of the atmosphere is shown under the examples given of the life of several wood pavements.

Having now somewhat hastily discussed the different influences that modify the action of traffic, it will be in order to take up the different kinds of pavements, and from representative examples deduce a general conclusion as to how long a certain pavement ought to last under different conditions:

Granite: It has already been stated that the foundation of a pavement affects its durability very much. Granite blocks are generally laid in two ways, viz: On a concrete base with joints filled with tar and gravel, and on a sand cushion with sand joints. The resulting pavements must be considered as being in separate classes. The reason why the same granite wears out more quickly when laid on sand is because the blocks follow any inequalities in the foundation and the sand in the joints is often washed out and allows more or less water to percolate down to the foundation, causing unequal settlements. All of these actions affect the stability of the blocks and often cause their displacement, thus preventing the traffic from being applied in accordance with the principle previously laid down, i. e., vertically upon the face of the block, and the result is abnormal wear. Probably the best example of a first-class granite pavement is that upon the approaches of the New York and Brooklyn suspension bridge. This was thrown open to traffic in May, 1883, and consequently has been in use about sixteen and a half years. During this time it has been subjected to a severe and continuous

traffic. The roadway is sixteen feet wide. The dimensions of the blocks are 3 to 4 inches wide by 8 to 9 inches deep and 9 to 14 inches long. These were laid on a concrete base and a two-inch sand cushion with three-fourths inch joints between courses. These joints were partially filled with tar and gravel which was thoroughly consolidated with a calking iron driven home by a heavy hammer when the joint was refilled as before. This pavement has received practically no repairs up to the present time, and Mr. Martin, engineer of the bridge, estimates its further life of ten years, or twenty-six years in all, for a pavement that probably sustains a heavier tonnage per foot of roadway than any street in this country. An article in the Eclectic Engineering Magazine states that on streets near the docks in Liverpool where the traffic was 360,000 tons per yard of width per annum, the average wear was .02 of an inch per annum. In Leith, Scotland, the repairs to granite are nil for the first ten years, and from that time to twenty-five years an average of 4 cents per yard per year. In Brooklyn, Clinton-st. was paved with granite on a sand foundation about twenty-three years ago. This is a residential street and has a moderate though not a heavy traffic, has received absolutely no repairs and is in such a condition today that from eight to ten years further wear may be expected of it. The authorities of the following foreign cities give as the life of granite pavement: Paris, Liverpool and Edinburgh, thirty years each, and Glasgow as high as fifty years. Engineers of the United States do not as a rule assign so long a life, and it is doubtful if our granite is as durable as that used in Europe, so that it is reasonable to suppose that their pavements will last longer despite their greater traffic. It would seem fair then to estimate the life of a granite pavement on concrete with tar and gravel joints at twenty-five years and on a sand base at twenty years.

Wood: It is extremely difficult to generalize upon the life of a wood pavement. It is laid of so many different varieties of material, and in so many different ways as to foundation and joint filling, and with such varied chemical treatment that a conclusion in one case will hardly have an application in another. For instance, the ordinary cedar block pavement as laid in Chicago and other western cities, requires replacing about every seven years. A similar cypress block pavement laid in Omaha in 1888 was taken up in 1892 and replaced with brick. Nicholson pavement laid in Brooklyn in 1869 had an average life of about six years, and in St. Louis of six years three months. A hemlock pavement was laid in Philadelphia as early as 1839, and was renewed in four years. Wood wore as follows in London: On Sloane-st, .065 of an inch, traffic, 279 tons per yard of width per day; on Fleet-st., .456 of an inch, traffic 1,360 tons per yard per day; on London bridge, King William-st., the blocks wore 2⅝ inches in three years and two months, where the traffic was 1,200 vehicles per yard for twelve hours. Mr. Haywood made the general statement that wooden pavements wore f rom .2 to .3 of an inch per year under a traffic of from 300 to 660 vehicles per yard for twelve hours. The Place de Concorde, Paris, was paved with wood in 1885, and relaid in 1895. The average annual wear of nine different streets was .1357 inch, the variation being from .0746 to .2908 inch.

Wood of the eucalyptus family has been used very successfully in Australia. It was first laid in 1860, and in a paper written by Mr. W. A. Smith, M. Inst. C. E., in 1894, many interesting facts are found. The blocks, three inches wide by six inches deep and nine inches long, were first dipped in tar and laid on concrete. The first pavements were laid with one inch joints filled with stone screenings or bituminous matter, but experience demonstrated that better results could be obtained with close joints except on steep grades. Mr. Smith states that on taking up a portion of a pavement laid with ⅜-inch joints filled with Portland cement grout, which had been down six years, dry rot had set in wherever the cement had touched the blocks while on another street, where the joints had been filled with a mixture of tar and basalt screenings, the wood was found to be perfectly sound; and although it had been in use eight years, it was practically as good as when laid, and the greatest wear observable was 1-16-inch under a daily traffic of 25,000 tons. On another street the blocks had worn 9-16 inch in thirteen years.

Mr. Smith estimates that Australian hardwood will last twenty-one years in a pavement and sustain a daily traffic of 1,200 tons per yard of width.

Mr. George W. Bell, formerly United States consul to Sydney, N. S. W., states that after eleven years several blocks taken from George-st. had worn less than ½ inch. The roadway of this street is forty-eight feet wide, and is subjected to heavy traffic. Mr. Bell estimates the life of the pavement at twenty years.

In 1895 a pavement was laid of Australian harri karri wood on Twentieth-st., between Broadway and Fifth-ave., New York City. The blocks were as above described, and after having their lower half dipped in hot tar were placed closely together on a concrete base, an open joint one inch wide being left at the curb for expansion. The joint was afterward filled with asphalt. At the present time there are very few blocks on this street that show sings of decay, but as a whole, where untouched by the plumber, the pavement is in as good condition as when laid.

In Europan cities the duration of wooden pavements is: Paris, 8 years; Liverpool, 15

to 18 years; Glasgow, 6 years; Edinburg, redwood, 8 years and Australian wood, 15 years, and London, 5 to 8 years for Baltic deal and 12 years for Australian.

The Tenth-st. viaduct in Omaha was paved with sawed cypress blocks in 1890. An inspector was sent south when the blocks were purchased who carefully examined all lumber before it was sawed so that none but the best would be used. This pavement lasted nine years. From the above figures it will be seen how impossible it is to deduct a positive result. But it does seem justifiable to conclude that a wood pavement that requires renewing in this country in less than fifteen years should never be laid.

Asphalt: This material has now been in general use in this country for about sixteen years. It has been laid under very different conditions, often by inexperienced workmen and on varied foundations, so that sufficient data has not been collected to give conclusive results. Many pavements have failed in attempting to economie by utlizing old material on the street. This has often been fatal economy, as asphalt depends entirely upon its base, the asphalt itself being only the carpet laid upon the foundation floor beneath. When the floor breaks the carpet must fail.

The following tables have been compiled from statistics from Washington, Buffalo, Cincinnati and Omaha, showing the cost of asphalt repairs under certain conditions in an attempt to ascertain when the economic end of an asphalt pavement comes. Before considering them it should be stated how the repairs were paid for and the tables were made up. Washington pays a price in bulk for material used; in 1897 it was for skimming or heater work, 95 cents per cubic foot, and where the old material is entirely removed, for wearing surface 52 cents and binder 30 cents per cubic foot, measured in the carts. Buffalo pays per square yard for actual work performed; the price in 1897 being for skimming 98 cents and for resurfacing $1.46, while in 1898 it had fallen to $0.64 and $1.05, respectively. Cincinnati paid a lump sum per year for the first and second five years after expiration of guarantee averaging .07½ cents per yard for the first and 14 cents for the second period over the entire area. The contract for the second period is still in force. When the original guarantee expired in Omaha in 1896, a contract was entered into with the asphalt company to keep all the streets paved at that time in repair for ten years at a cost of 8 cents per yard per pear.

Here are four different systems of making repairs. It will be readily seen that in deciding what it will cost to repair a pavement five, or, as was the case in Omaha, ten years in the future at a time, too, when no asphalt pavement had been down fifteen years, any company must make a guess at the cost and that the guess willl be made on the safe side.

Table No. 1 shows the average annual cost per yard for asphalt repairs after the expiration of guarantee at the end of different periods.

Table No. 2 shows the average cost per yard for each year after guarantee has expired, the figures being compiled from the reports of 1897 for Washington and Buffalo and from personal information for Cincinnati and Omaha:

TABLE NO. 1.

Year out of guarantee.	Washington.	Buffalo.	Cincinnati.	Omaha.
1	.000417	.0132	.075	.08
2	.00159	.0234	.075	.08
3	.....	.0229	.075	.08
4	.....	.0391	.075	.08
5	.0071	.0521	.075	.08
6	.0143	.0916	.0858	.08
7	.03616	.0749	.0936	.08
8	.04518	.0502	.0994	.08
9	.04421	.0691	.1039	.08
10	.04815	.0219	.1075	.08
11	.03816	.0200	.....	.0754
12	.02318	.0280	.....	.....
13	.0747	.0415	.....	.....
14	.1223	.....	.....	.....
15	.0773	.....	.....	.....
16	.....	.....	.....	.....
17	.0241	.....	.....	.....

TABLE NO. 2.

Year out of Guarantee.	Washington.	Buffalo.	Cincinnati.	Omaha.
1	.0039	.029	.075	.08
2	.0074	.057	.075	.08
3	.045	.051	.075	.08
4	.034	.095	.075	.08
5	.054	.074	.075	.08
6	.057	.084	.140	.08
7	.068	.056	.140	.08
8	.086	.042	.140	.08
9	.072	.027	.140	.08
10	.060	.031	.140	.08
11	.035	.040	....	.03
12	.031	.040	....	...
13	.033	.106	....	...
14	.026	....	....	...
15	.025	....	....	...
16	.128	....	....	...
17	.031	....	....	...

The guarantee in every case is five years, except for the streets paved in Buffalo in 1886, when it was eight years. Applying now the formula presented for ascertaining the economic end of a pavement, it will be seen that Cincinnati has about reached the limit where new pavements are required. As a matter of fact, this 14 cents being an average several streets have probably passed the point where it is profitable to repair them. Omaha's price being the same for the whole time gives no information, but with the exception of the thirteenth year after laying in Buffalo and the twenty-first in Washington, none of the others seem to be suffering from use or time. It will be noted, however, that about midway in the record of the last two cities are four or five years where the cost appreciably exceeds those immediately before and after them. This probably means that the repairs on some streets were abnormally high during those years. It must be remembered also that, while these figures represent cost, they do not necessarily indicate the relative amount of work done, as the reduced price per yard in Buffalo for 1898 over 1897 would allow about 40

per cent. more resurfacing to be done without increasing the cost.

No arbitrary life, then, can be assigned to an asphalt pavement. Paris allows 15 years, Liverpool 12, and Edinburg from 12 to 15 years.

In Leith, Scotland, one asphalt street averaged 5 cents per yard annually for fifteen years succeeding the third year after it was laid.

The author, in the light of figures herein given, would consider that in the United States an asphalt pavement, properly laid and maintained, should last from 15 to 20 years under average conditions.

Since this paper has been written the report of the board of public works of Buffalo for 1898 has been received. This shows the average cost per yard of all asphalt maintained in Buffalo during the last four years to be, 1895, $0.067; 1896, $0.0439; 1897, $0.0480; 1898, $0.0268. These, it must be remembered, are averages. The engineer in the same report submits a list of 27 streets which he recommends for resurfacing, as they have cost a total of from $0.2234 to $1.20 per yard for the last four years. Only 2¾ per cent. of the entire pavement under maintenance was repaired in 1898, as against 5½ per cent. in 1895.

Brick: As at present laid, brick pavements have not been in use long enough in this country to enable one to make anything more than an estimate of their probable life. The early pavements were laid in small cities where the travel was light and where the streets were not kept clean. On the other hand, the bricks as compared to those of the present time were poor and poorly laid. A brick was too often considered to be a brick and one as good as another. Many experiments were tried with foundations, sizes, and material for joint filling, and even now these items are not all satisfactorily settled. It is generally considered by engineers that sand is the poorest filler, yet Mr. Cappelen, city engineer of Minneapolis, states in his report for 1898, that when that city asked for bids for furnishing brick for the city's use with a fifteen-year guarantee and allowing the manufacturers to state their preferences for a joint filler, one firm preferred sand for that purpose and refused to guarantee its brick for more than five years unless sand was used.

Many of the early pavements were very durable. One in Bloomington, Ill., laid in 1875, was removed in 1894, when the bricks were worn off ¾ inch. Another at Charleston, W. Va., lasted still longer. Many others, failed quickly on account of poor material being used and bad construction. The paving brick of today are very different from those of twenty years ago, and they are laid much more intelligently. In his report for 1897 the city engineer of Des Moines estimates the life of a brick pavement in that city to be from 12 to 15 years on a business street, and from 25 to 30 years on a residential street. The city engineer of Peoria, Ill., estimates the life of a brick pavement at 25 years, and the enigneer of Bloomington, Ill., at from 15 to 20 years. The superintendent of the water works at Steubenville, Ohio, writes that the first brick pavement was laid in 1884, is in good repair at the present time and will last ten years longer without repairs.

In 1895, Nevins-st. in Brooklyn was paved 22 feet wide with Metropolitan blocks from Canton, O. The street has a moderately heavy and continuous traffic. During the present summer the brick were measured in the center of the street and except in a few cases there was no perceptible loss. It seems safe to predict for this pavement a life of from 10 to 12 years despite the traffic. In a residential portion of the city it would surely last 50 per cent. longer.

Philadelphia, where there is probably more miles of brick pavement than any other city in the world, estimates its life at ten years. The author, however, thinks he is conservative in assigning it a duration of fifteen years when the brick are well vitrified and properly laid.

Macadam: This pavement can be truly said to have no end if properly cared for, but it requires an almost constant infusion of the elixir of repairs to bring about this eternal life. The exact amount depends upon the traffic and character of the stone, varying greatly in different cities. Nashville, Tenn., renews some of her streets twice in one year. One technical journal states that a street in St. Louis has had enough broken stone spread upon it to raise its surface twenty-two feet. In 1884, in London, macadam on Parliament-st. cost $0.70, on Whitehall-st. $0.71 and on Victoria-st., $0.50 per yard for repairs. Glasgow maintains her macadam streets at an annual cost of $0.12 per yard, while Paris in 1893, paid $0.44 for the same purpose. The author will not attempt to assign a limit for macadam.

In summing up the conclusion arrived at in this paper it must be borne in mind that the results are very general, subject to many modifications, but based upon good material being laid in a proper manner and each pavement under conditions fairly favorable to its use.

The estimated life then is, for granite, on concrete, 25 years; on sand, 20 years. Brick, 15 years. Wood, 10 to 15 years. Asphalt, 18 years.

BRICK PAVING IN SEVERAL CITIES.

By L. M. Hastings, City Engineer, Cambridge, Mass.

In most of the cities of the East paving is but little known. The nearness to good granite quaries from which to obtain granite block paving of a superior quality, also the abundance of hard ledges from which to obtain cracked stone, has led to the general practice of paving business streets, carrying heavy traffic, with granite blocks; streets with lighter traffic with asphalt, and by far the larger part of residence and suburban streets with macadam of varying degrees of thickness and merit. The construction of macadam pavements has here reached a high degree of efficiency. I doubt if anywhere in this country can such fine macadam roads be found as may be seen in many of the parks and suburban

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localities of the eastern New England and middle states. Material and skill have both been plentiful to produce this result. There has long been a desire, however, in more thickly settled communities for a pavement which, while having, in a good degree at least, the qualities of durability undoubtedly possessed by granite, should yet be superior to it in smoothness, noiselessness and ease of traction. Many object to asphalt on account of its cost, slipperyness and doubtful lasting qualities.

Vitrified paving brick was suggested as a paving material, having in a good degree many of the qualities desired, and so a committee of the city government was authorized to make a tour of inspection to some of the cities where brick pavements had been used for a number of years to ascertain if their experience would warrant the trial by the city of Cambridge of brick as a paving material on certain streets of the city. Springfield, Mass., Albany, Rochester, Buffalo and Tonanconda, N. Y., Cleveland and Canton, O., were visited, and also several of the large brick-making plants in New York and Ohio.

Many conflicting reports were received of the results of time and wear in the brick pavements in use; some stating that the brick pavement after a few years' use was failing utterly, crumbling and going to pieces, others stating that it seemed to wear as well as granite, the inevitable eastern standard of durability.

A somewhat careful examination and inquiry of the brick pavements in the cities visited did not reveal a condition such as the first statement would lead one to expect. The oldest bricks seen were said to be about ten years in service and were made in small sizes of apparently common building brick clay. These, while badly chipped and having some soft or underburned brick, still seemed good for several year's wear. One small patch was in really bad shape. In general it may be said that the evidence of durability in good selected brick were better than we had been led to expect.

Inquiry and correspondence revealed at the outset another fact—that, young as the industry is, a most surprising number of factories are now equipped for and are manufacturing paving brick; also that a most intelligent and careful study and comparison of facts relating to the proper materials, their combination and manipulation during the course of manufacture, and a scientific study and comparison of results obtained by laboratory experiments, as well as practical use on streets had been given to the matter.

The work of Mr. Purington of Chicago, Prof. Orton of Columbus, O., Prof. Marston of Iowa, Prof. Johnson of St. Louis and others has been of the greatest service, while the patience and skill of the numerous manufacturers and inventors of brick-making machines have largely contributed toward bringing the process of making a satisfactory paving brick to a success.

Large as the number of manufacturers are, scattered widely, and using various materials, it is not surprising that their product shows a marked variation in many important particulars. I should roughly class paving brick as now made by the materials used, into shale brick, fire clay brick and mixed shale and fire clay brick.

Samples of all these kinds were seen in service in the cities visited. Special merits are claimed for each of the materials used. It seemed to me that each had some points of superiority and each might be adapted for certain situations by these qualities. Thus the shale and largely the mixed shale and fire clay bricks seemed hard, dense and heavy, with a tendency toward brittleness. These bricks seemed adapted for streets with heavy traffic if laid on a heavy concrete base, with joints thoroughly filled with cement to reinforce the edges and corners to prevent the chipping so noticeable in many pavements.

The fire clay bricks, on the other hand, are lighter, softer, more porous, with apparently less tendency to chip and crack, but more subject to wear by grinding of wheels, hoofs, etc. These brick seem excellently well adapted for a residential street or one carrying a light local traffic. The soft, pleasing colors obtained in these brick must prove an attraction to residents on a street paved with them. This was particularly noticed on some streets in Tonawanda, N. Y., and in several cities seen in passing through Pennsylvania. It would seem, too, that this brick, being softer, would be less noisy than the harder shale brick. Just how far the two materials may be combined with any advantage is one of the nice points which is very difficult to determine.

Several specimens of street paved with the brick made of mixed materials were seen, which seemed to be standing well. It is claimed by the manufacturers that the introduction of a part of fire clay makes the burning of the brick easier, as the mixed material will bear a higher degree of heat than the bricks made of shale and clay.

At the factories visited the principal operations in the process of brick making were quite simple, although the details on which the success of nearly all operations depended, required much thought and care. The materials, shale and clay, were dug from the bank and mixed in the required proportion either at the bank or at the mill. It was then finely ground, moistened to a proper degree and put through the brickmaking machine. The clay is pressed from the machine through a die of the size of the brick in a continuous stream and cut by wires into blocks such as will make the required size when dried and burned.

The best size for the brick is a subject about which much diversity of opinion still exists. In general, three sizes are now in use—a small brick size, a larger size, or "paver," and the largest size or "block." The last two are the sizes most commonly used, and as to which is the best there seems no general agreement.

As the bricks leave the machine they are rectangular in shape, with the sides somewhat rough by having been cut by the wires, and the corners rather sharp.

If desired, the brick are now put into a machine and "repressed," by which the corners and edges are rounded and a more perfect shape and appearance given to the brick.

Much discussion has been had over this operation as to whether the repressing is a benefit or, as some still claim, a positive injury to the brick. Both "wire cut" and "repressed" pavers were seen in the pavements examined, but no conclusion could be drawn from that, as no difference could be noted in the results of wear, etc. The repressed brick make a smoother and better looking pavement at only a trifling increased cost.

A very important element in the manufacture of a paving brick is a proper burning or degree of vitrification. Properly speaking, a thoroughly vitrified brick would be totally unfit for use as a paver, being glassy and brittle in texture and misshapen in form. It is never attempted to more than partly vitrify a brick, melting the more fusible elements or "fluxes" which form a small percentage of the material, and so uniting the more stable elements and silica which form the greater bulk of the clay, into a hard, durable, homogeneous mass. It is one of the nice operations of the manufacturers to give a kiln containing say 100,000 paving brick just the right degree of heat for from eight to ten days, so that the larger part of the brick shall be burned or vitrified to just the right degree; for it is a fact that the limit of range of burning within which the best results are obtained is quite small.

The very interesting experiments of Prof. Marston of the Iowa state university, made in 1898, demonstrate this very clearly. One thousand brick each were given by two well-known brick manufacturers in the West for the purpose of experiment and test. These brick were sorted into six different grades, according to the amount of burning and consequent hardness. In nearly all the tests given the brick which had just the right amount of burning, marked No. 1, stood higher than those which were burned less or more. The necessity for care in burning and in properly selecting the brick to be used for paving was also seen by the results observed on pavements, the brick for which had not been carefully culled.

The lighter colored softer brick, noted in some of the older pavements seen, showed the effects of wear much more than those of a darker, harder character. It is highly desirable that the bricks should all be of one uniform degree of hardness. This can only be accomplished by the most careful burning and a thorough selection or culling out of inferior brick before laying.

The character of the material used in filling the joints between the brick must have an important influence on the success and durability of a brick pavement. Various materials have been used, sand, paving pitch of coal tar or asphalt, a cement made of ground slag and cement, called "Murphy grout" and Portland cement.

Sand, while at first making a good filler,

being inexpensive and reducing the liability of the pavements being noisy, soon washes out and leaves the edges of the brick unsupported and so much more liable to become chipped. Pitch, unless made very hard, tends to soften too much in hot weather and run toward the low places in the pavement as the gutters, leaving the higher parts unprotected.

The Murphy grout works well in places, being fairly hard and elastic, but is said to be uneven in its results, the filling of this material in places being absolutely worthless.

The best results, on the whole, seem to be obtained by using a high-grade of well-seasoned Portland cement containing the smallest amount of free lime in its composition; the presence of the lime increasing the tendency for the filler to swell with age and the absorption of moisture, causing the pavement to rise and lift away from the foundation, and so producing the disagreeable roaring or rumbling noise occasionally heard in an otherwise unobjectionable pavement.

It is now thought that this tendency to lift is remedied by introducing at intervals of 25 to 30 feet across the street and on both sides of the street at the curb, an expansion joint of pitch, so that any movement of the pavement due to swelling of the filler, or to change in temperature will be taken up by the elasticity of the pitch joints.

Various types of foundations were noted as being tried in the various cities visited, the best and most satisfactory kind for heavy traffic and poor natural conditions being a layer of 6 inches of American cement concrete placed on the surface of the street after being graded to sub-grade and thoroughly compacted by a steam roller. On this was placed a sand cushion one inch or two inches thick, and on this brick was laid. Cracked stone was said to have been used in some places, but with not very satisfactory results; the sand cushion having a tendency to wash into the voids in the stones.

It has seemed to me that if the cracked stone were used without screening and a layer of sand or fine gravel spread on the stone, then wet thoroughly and rolled, that a very satisfactory and economical foundation would be made.

In some cities where clayey soil is encountered it is considered necessary to provide under drainage for the foundation, the common method being to place a sub-soil drain under the curbstone at each side of the roadway and about three feet below the surface. The trench is filled with small stones and the curb set in that as a foundation.

In the preceding remarks little or no attempt has been made to enter into a discussion of the fine and mooted points of the subject, the best materials to be used in the manufacture; the best size to be adopted; whether the bricks are better "side cut" or "end cut;" whether repressing is an advantage or an injury; the proper point at which vitrification or burning should cease; the kind of kiln in which the best results are obtained, etc. These have been exhaustively treated by experts familiar with the theory and best practice of the subject.

After the visit of inspection and a careful consideration of the information and experience obtained, the following recommendations were unanimously made to the city government and are now being carried out:

First—That vitrified repressed shale brick be used as a pavement in Prospect-st., Pearl-st., Portland-st. and Harvard square.

Second—That the particular make of brick to be used be left to the discretion of the superintendent of streets and the committee on roads and bridges.

Third—That authority be granted the superintendent of streets to contract for the required amount of paving brick with or without advertising therefor at his discretion.

Fourth—That the pavement be laid in a base of cement concrete six inches thick, with a cushion of sand about two inches thick between the concrete and brick, and the joints be filled with Portland cement provided with expansion joints of asphalt pitch at proper intervals.

Fifth—That the work of laying the entire pavement be done by the day by the superintendent of streets.

Sixth—That before the pavement is laid all sewers and sewer connections, water and gas pipes and service connections be required to be laid to the curb line.

Seventh—That in case it is required at any time to open any street paved with brick pavement the entire work of making such opening and restoring the pavement be done by the superintendent of streets and the entire expense of such opening and restoration be charged to the party, corporation or department requiring such opening to be made.

THE PHYSICAL PROPERTIES OF ASPHALTS AND ASPHALTIC CEMENTS.

By W. H. Broadhurst, Chemist, Department of Highways, Brooklyn, New York.

It is only within the past five years that domestic asphalts have met the imported product in successful competition in our eastern cities. Vast deposits of natural bitumen have been opened up in California, Utah, Indian territory and Texas. The output from these states includes malthas, or natural asphalt fluxes, and hard asphalts in various grades of relative purity. A number of these have already proved their suitability for paving purposes—so that, while the Trinidad product was used almost exclusively in the early days of the industry, today the expert is called upon to pass judgment on over a dozen relatively pure paving

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asphalts, and an endless number of rock asphalts, asphaltic cements, and asphalt fluxes, both natural and artificial. It is hardly necessary to add that there are asphaltic cements on the market composed of nearly every available kind of cheap bitumen. As the purpose of the asphaltic cement in a pavement is to bind the particles of sand together—a function purely physical, a consideration of the physical nature of the pure bituminous matter which it contains is of great importance, and should in all cases supplement the chemical examination.

Asphalts vary in proximate composition according to the character of the geological formation in which they exist. As found in nature, they contain a cementitious substance called bitumen, and a certain amount of foreign matter, mainly mineral, which varies in different deposits from merely a trace in some cases, to 90 per cent. and over in others. These latter include the asphaltic sandstones and limestones. This mineral matter, if it be inert and insoluble in water, is of no detriment to the use of an asphalt for paving purposes. It is the non-bituminous organic matter which is prejudicial.

If any of these asphalts be submitted to the action of a solvent, and then filtered, it will be found that the bitumen dissolves, leaving the foreign matter on the filter as a residue. After the complete evaporation of the solvent from the filtrate of such solutions, the bituminous substance from each will be left in a state of purity, and a fair comparison of their physical properties is then possible. The physical properties of these pure bitumens, dependent on the molecular forces of cohesion and adhesion, will be found to include the following:

Properties dependent on cohesion:

Consistency (relative hardness of softness)
Viscosity
Tenacity
Elasticity
Fracture

Properties dependent on cohesion and adhesion:

Capillarity
Ductility.

It will be found that all pure asphalt-bitumens exhibit these properties in a greater or less degree, dependent on the consistency. They are all viscous—that is, they flow or are capable of flowing. This is the characteristic property of asphalt bitumen and is perceptible even in the hardest varieties, although the motion is very slow. Maxwell* has pointed out that "when the very smallest stress, if continued long enough, will produce a constantly increasing change of form, the body must be regarded as a viscous fluid." Under this definition viscous bitumens must be regarded as liquids, no matter how hard they may be. Hard bitumens must be regarded, however, not only as liquids, but as liquids which contain a solid in solution.

This solid is called "asphaltene" and when present in sufficient quantity, the bitumen shows a characteristic conchoidal fracture—a property of solids. This property of fracture is evident even in comparatively soft bitumens when struck a

*Heat, p. 236.

sharp blow. For paving purposes it has, therefore, been found necessary to temper hard asphalts wtih a flux or softening agent so as to reduce this property of fracture or brittleness, which becomes more marked as the temperature decreases, to a minimum, and still give an asphaltic cement of sufficient tenacity to produce a surface mixture with a given sand, that will not mark readily under traffic on the hottest days of summer. There are two kinds of flux in use for this purpose; malthas, or natural bituminous fluxes, and petroleum residuums, or artificial bituminious fluxes—the one class composed of soft natural bitumens of high viscous index, and of the same nature as the asphalt; the other class composed of liquid paraffines, of little viscosity, and which change rapidly on the reduction of the temperature to a soft solid of no viscosity. "Pittsburg flux," made by heating petroleum residuum with sulphur, has also been used to some extent to replace a portion of the petroleum residuum in asphaltic cements. It is a soft solid. These artificial fluxes differ markedly from natural bitumen, not alone in viscosity, but also in ductility—they are termed "short;" that is, they cannot be drawn out into a long string. Malthas, however, are ductile in a very marked degree and the same property is more or less manifest in the hard asphalts on the application of heat. This property, together with elasticity in the asphaltic cement, is of primary importance, admitting of expansion and contraction in the pavement without cracking. It is obvious that the flux must impart its properties to the asphaltic cement containing it. To show the comparative ductility of pure asphaltic cements made of pure Trinidad bitumen and petroleum residumm, pure Bermudez bitumen and petroleum residuum, and pure Alcatraz bitumen and California (Alcatraz) maltha respectively, the following experiments were carried out:

Twenty grams of pure bitumen were exphalts with chloroform. The last portion tracted from each of the above named asof the solvent was removed by heating the extracted matter in flat-bottom dishes at 212 degrees F. for eight hours, the temperature being raised to 300 degrees F. for ten minutes at the end of the operation. To the pure Trinidad bitumen, petroleum residuum was then added to the amount of 33 per cent. of its weight. (This percentage is calculated from the usual proportion of eighteen pounds of residuum to 100 pounds of refined Trinidad asphalt containing 55 per cent. bitumen.) The penetration was then taken with the Bowen penetration machine and found to be 40 degrees at 80 degrees F. The pure Bermudez bitumen was brought to the same degree of penetration, requiring approximately 13 per cent. of its weight of petroleum residuum. The pure Alcatraz bitumen required approximately 24 per cent. of Alcatraz maltha (2-x grade) to give a penetration of 40 degrees. As a matter of technical interest a separate portion of pure Trinidad bitumen was brought to a penetration of 40 degrees with Alcatraz maltha. These four cements were poured while hot into glass tubes two and a half inches in length and five-sixteenths of an inch in internal diameter, closed at one end with a cylindrical cork. These tubes had previously been cut in half, the edges ground true to plane and cemented together with a thin film of "plaster of Paris." This cement joint being easily broken by a slight side pressure, we have in each case a uniform cross-section of pure bitumen, and the weight of each tube being the same, a uniform force acting on it. These tubes were kept at a temperature of 80 degrees F. for one hour. They were then clamped in a vertical position, and in each case the lower tube was separated from the upper a distance of exactly one-quarter of an inch. The lower tube was then allowed to draw apart from the upper under its own weight, thus pulling the cement out into a string, the cross-section decreasing as the length increased. The distance between the tubes at the time of rupture was noted and the following results obtained:

RELATIVE DUCTILITY OF PURE ASPHALTIC CEMENT.

Sample No.	Composition of Cement.	Penetration at 80°F.	Ductility at 80°F. (Length)	Ductility at 90°F. (Length)
1.	Pure Trin. bitumen residum	40 deg.	½ in.	¾ in.
2.	Pure Bermudez bitumen residuum..	40 deg.	1½ in.	2½ in.
3.	Pure Alcatraz bitumen, Alcatraz maltha	40 deg.	2¼ in.	4½ in.
4.	Pure Trin. bitumen, Alcatraz maltha...	40 deg.	2⅛ in.	4¼ in.
	(Additional Tests.)			
5.	A Commercial Paving Matrix, 99 per cent. bit....	40 deg.	⅜ in.	.....
6.	Soft Alcatraz asphalt, (pure bit.)..	50 deg.	4½ in.	.....
7.	Uvalde asphalt, Alcatraz maltha	50 deg	5½ in	.....

The rate at which the tubes separate in these tests may be taken as a measure of the tenacity. Capillarity and elasticity are also shown in sample No. 7, containing Uvalde asphalt. This sample also showed the greatest ductility. Other cross-sections and standards of consistency may be used; but each test being conducted under exactly similar conditions, the results will be comparable.

In regard to the use of fluxes there remains another side of the question to be considered. Richardson* has shown that these malthas lose a much larger percentage of matter volatile at temperatures

*Municipal Engineering, July, 1898.

of 325 degrees Fahrenheit and 400 degrees Fahrenheit, than residuums, the effect being to harden the maltha. This test for "'matter volatile," however, should be conducted not alone on the maltha, but also on the asphaltic cement. In the latter case, the more stable oils (volatile between 250 degrees F. and 400 degrees F.) volatilize with difficulty, being mixed with and protected by a large bulk of hard bitumen. The writer has found that good California malthas do not volatilize more than the following percentages of light oils, if heated at the following temperatures, in bulk to the amount of 50 grammes in an open evaporating dish:

Matter volatile at 250 degrees F. in 8 hrs., not over, .50 per cent.

Matter volatile at 325 degrees F. in 8 hrs., not over, 4.50 per cent.

Matter volatile at 400 degrees F., in 8 hrs., not over, 7.50 per cent.

If the percentage of volatile oils in a flux runs appreciably over these figures, it should be further refined or entirely rejected. After the cement is once in the pavement, hardening due to ageing is no more rapid in cements containing good malthas than in those made with residuums; and, further, we know that the hardening of malthas in nature is a very slow process.

SOME EXPERIENCES WITH PORTLAND CEMENT.

By W. K. Eldridge, City Engineer of Lafayette, Ind.

The demand for Portland cements in all classes of work having been greater than the supply for several years past, has almost irresistibly tempted manufacturers to make premature shipments, adulterations and otherwise to issue defective goods, thereby placing an added burden and anxiety on the conscientious engineer in his endeavors to prevent the use of unseasoned and otherwise unsuitable cements, particularly in the construction of cement sidewalks. This he attempts by subjecting the cement before using to the usual tests now universally prescribed in all satisfactory specifications; but my experience of the past two seasons has indicated that the present method of conducting cement tests does not afford the engineer all the information he should obtain before an acceptance of the cement. Even if he takes the ill-spared time from his other duties to make a determination of the relative proportions of lime, silicia and alumina, he would probably get no information of other possible ingredients of an injurious nature, and be left as helpless as before.

Our tests as heretofore made are the usual ones for fineness, time of setting, constancy of volume and tensile strength; but it is easy to reason from a comparison of a number of results, including the action of the work after construction, that such tests may be and I believe are at times more or less deceptive and insufficient for perfect safety.

For instance, it is becoming customary for manufacturers to give artificial age to their cements by adding certain quantities of sulphate of lime. It has long been known that an excess of the sulphate is injurious to the cement, besides concealing certain actions that a test should be permitted to develop if it is to be reliable; but the temptation to go to excess in order to send out a product that will pass the usual tests without waiting for the proper age or requiring the extreme care necessary in its manufacture is evidently yielded to in many cases, our experience having fully shown that an honestly made cement not sufficiently aged will fail under the steam or boiling water test, thus betraying its immaturity, while a reinforced cement, though equally green, will pass all the tests that so far are customary.

Any cement containing more hydrate of lime than is necessary for combination, with the silica to form the tri-silicate of lime, runs the danger, in proportion to the excess, of the conversion of the free lime into the carbonate of lime, which action causes the cracking and seaming so common in cement walks. The boiling water test is intended to show this in a few hours, while it would require a long period of time otherwise. But since the presence of sulphate of lime will enable the cement to "boil" safely (and the greater the amount the surer it will "boil"), and further, retards the action of the free lime in the work, sometimes to a late day, all value in this test is wholly lost when applied to "doctored" cements.

Another inducement for the manufacturer to use sulphate of lime in dangerous quantities comes from the present demand for very finely ground, slow-setting cements; and as fine grinding hastens setting, a corrective must be applied, and if carried to excess, future disintegration is sure to occur, and the usual tests afford no warning. A demand for high initial strength is also called for in connection with slowness of setting, and those two qualities are also hostile; but since the immediate damaging effects of an excess of lime necessary to produce this high initial strength are concealed by the addition of sulphate of lime, we have a cement, finely ground, slow setting, of high tensile strength, but very dangerous to use.

Having drawn a sample of a certain cement which failed under the boiling water test, I had the experiment made of aging

the cement artificially, using different proportions of sulphate of lime in regular proportions until the cement would not endure the test. No tests were made to determine whether the cement was over-limed or simply too new; nor was any demonstration made of any sulphate that might have been in the cement before making our additions. When more time permits we expect to go into this part of the matter more deeply.

It was noticed that the cement required more water for guaging as the per cent. of sulphate was greater.

Summarizing the results of the experiment, it shows that the time of setting is retarded quite uniformly with the progressive increase of sulphate, and also that the capacity of resistance to the effects of the boiling water was strengthened in the same manner.

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City Engineer of Lafayette, Ind.

So we find that in this particular case the addition of 3 per cent. sulphate of lime made the cement acceptable according to the prescribed standard of tests. If the cement then were accepted and used it may be subject to one of three causes for disintegration. If too new, or if over-limed, or if under-burnt, in either case the damaging effect of the free lime is only suspended, its time of action only retarded. If carbonate of lime had been added instead, the effects are the same, except that the disruptive elements in the cement may not show themselves for a year or more after being made, so slow is their development.

The detection of over-limed cements is often attempted by taking the increase in temperature during setting. This is a certain test provided the cement has not been "doctored," when the test fails, and the effect of the over-liming is retarded for weeks or perhaps months, but is almost sure to make the finished work unsound. In one case, where the temperature rose 23 degrees in five minutes the addition of only 2 per cent. of the sulphate so changed the action that the rise in temperature was only 1 degree in fifteen minutes.

It seems, then, certain that under present conditions of manufacture the rise in temperature and boiling water tests do not insure a sound cement.

Again, the tests for tensile strength show the progressive action of the sulphate of lime in imparting what may prove to be a meretricious strength to the cement, with a corresponding deception to the user.

In all the voluminous literature on cements, references to this branch of the subject are meager and unsatisfactory, some of them being positively erroneous. For instance, in a book on engineering construction by a well-known engineer of reputation, and much used as a text book, the statement is made that sulphate of lime quickens the setting time of cements. The theory that plaster of Paris, being a quick-setting material, imparts this property to what it is mixed with, seems plausible, but is denied by experiment. Why this is true seems so far to be unknown. The conclusion is also indicated that an unusually high tensile strength at an early period is a suspicious rather than a meritorious circumstance.

In this connection, however, it should be remembered that almost all investigations in connection with cements have been and are being made by chemists in the employ of various cement manufacturing companies, and the information gained by each is carefully guarded by their employers as part of their stock in trade, not to be imparted to their rivals or customers. The benefits of the impartial and independent investigations of the properties of the constituents of asphalt pavements, as carried on by the city laboratories of Washington, Brooklyn and others, are well known and appreciated by the members of this society, and similar work and publications from the same sources on cement would be equally valuable. The competition among manufacturers to produce cements of high tensile strength has, I believe, deceived engineers into raising their requirements to correspond, until the danger line has been passed. One city has been raising the standard each year for a number of years, and parades this before the world as a virtue; but the manufacturer simply winks the other eye and produces a cement to correspond. The composition of cements and method of production are not now so different from ten years ago that a cement honestly and naturally made from the same rock and clay as then will now show double the tensile strength legitimately.

Authorities, what few there are, are much at variance about the amount of sulphate of

lime permissable in Portland cements before injury is worked, one insisting on a limit of 1½ per cent., while another claims that 8 per cent. is allowable, with various other opinion in between, until the practicing engineer feels pretty much at sea in the matter. He is probably safe in adopting the minimum requirement, but with the risk of ruling out many good cements which overstep that limit, for it is possible that a safe amount in one cement might be injurious to another. But the worst feature is in the capacity of the sulphate to conceal bad qualities in cements totally disconnected with the sulphate itself. The question that confronts him is, where shall he is it for him to undertake a tedious and take his stand, and what can he do to protect himself and his work? What benefit possibly expensive quantitative analysis of each sample, if a permissible limit cannot be decided upon, beyond which rejection shall be obligatory? It might be suggested that the minimum proportion of sulphate of lime allowed should not be so great as to prevent "blowing" under the boiling water test, if the cement be so constituted as to fail under this test. This rule would seem to place the limit at about 2 per cent., and it might well be less.

If it would be possible to decide this point, and then prescribe one or more tests that would be adequate, easily performed and inexpensive, certainly a great stride forward would be made toward insuring good work of reliable duration. But as the matter now stands, such tests as it is now customary to prescribe in specifications, fail to assure the engineer sufficient guaranty that his work will endure the test of time and the elements.

The idea of a rough and ready test for sulphate and carbonate of lime has taken form out of some of our laboratory experiments and may briefly be stated as follows:

After first trying the boiling test (for if the cement fails under this it is rejected by the terms of the specifications anyway), dissolve a portion of the sample in diluted hydro-chloric acid, when, if carbonate of lime be present, a strong effervescence of carbonic acid gas will take place; and as the carbonate should never be present in any good cement, sufficient grounds for rejection are found at once. The solution should be perfect, though it need not be absolutely clear; and if there be a residue on the bottom of the glass there is a strong suspicion of adulteration. If, however, nothing suspicious be found so far the solution may be filtered and boiled and a small quantity of barium chloride added, which will, if sulphate of lime be present, cause a precipitate which can be taken as a measure of the sulphate for comparative purposes. In order to have a standard for comparison let a competent chemist take a sample of cement known to be reliable and accurately determine the percentage of calcic sulphate, if any, and then add enough to bring it up to the allowable limit, say 2 per cent. Then the quantity of the precipitate under barium chloride may be preserved by sealing the beaker; and if all future tests are made with the same quantity by weight of cement in the same size of beaker, a visual comparison can be made with the prepared standard close enough for practical purposes.

But there is another danger attending the use of Portland cements, as now made, owing to their adulteration with slag cements, or possibly ground slag itself. A great and growing industry in this country as well as in others is the manufacture of cements from blast furnace slags, going under the name of "Portland" cements. Blast furnace slag being a waste product its use for such a purpose renders possible the making of a cheaper cement, which, if as good as the regular make, should not be kept out of use. And yet, for sidewalk purposes, any engineer having experimented with this material will not consent to take any more of it in sidewalks. At the same time, it has its legitimate uses and when submitted to the regulation tests it rarely fails to fulfill all the standard requirements, and a contractor standing squarely on his rights and dignity can compel you to let him use it. So far this season I have barred it out of sidewalks by insisting that it is not a true Portland cement, but with the expectation some day of having my ruling contested and beaten. There are some slag cement walks which appear good and durable, made of a certain brand, the manufacturer explaining that he puts the slag through a roasting process before mixing and grinding, but I fear that the engineer who accepts even this cement too trustingly would lay himself liable to a roasting also. But if there be any distinction between slag cements for sidewalk use there is certainly so far no prescribed test by which this distinction can be determined. Ground basic slags are so unstable in their composition that they have to be kept tightly corked in the laboratory to hold them from the continuous disintegration which goes on during exposure to the air. In undergrund work, such as street and other foundations, slag cements seem to give good results and cheapen cost, but in the case of sidewalks, a granulating and rubbing off of the surface seems to be continually going on, as in some cases now under my observation, which cannot, I believe, be attributed solely to the traffic. There are so many different constituents in slags, and so many variations in their relative proportions in different slags, that a uniform and reliable product for such extreme service as sidewalk use can hardly be expected.

It is only occasionally that ores and fluxes employed in blast furnaces will produce slag suitable for cement. Also, all such slags are devoid of hydraulic properties unless a change in their composition be effected.

A common use for slag cements which our experiments are pointing to is as an adulterant for regular made Portland cement by which the cost of production may be cheapened and output increased when demands are pressing. This was first noticed in some of the German cements, from which quite an appreciable amount of finely comminuted metallic iron or steel may be extracted by a common magnet, and the same thing was more recently found in two brands of American-made cement, amounting, even by this rough-and-ready method of analysis, to about one part in one thousand. It may be that the particles of metal themselves are not injurious except to the pocket, the purchaser buying one barrel of useless metal and 999 barrels of cement; but if such a complex and mysterous substance as basic slag be present, the risk remains of some one or more of the elements affecting a structure, such as a sidewalk exposed to all the effects of heat, cold, water, frost, etc. A sample of acknowledged slag cement showed one part in about 300 of metallic iron, so that the possibility remains of a Portland cement being adulterated with about 30 per cent. of slag, and yet pass all the customary tests, and under the usual specifications would have to be accepted.

A statement of the foregoing was sent to a prominent New York engineering periodical, whose editor gravely advanced the explanation that the presence of iron could be accounted for by the wear of machinery. But since many cement plants produce 1,000 barrels per day, any set of machinery that can make a daily contribution of 400 pounds of its substance to its product must, like the widow's cruse of oil, have the miraculous faculty of self-restoration between days.

A series of simple tests for slag adulteration may be carried on by anyone with slight chemical knowledge and little paraphernalia. The presence of metallic steel is a sure indication, as no such particles should be present in an honestly made cement. Shake a little of the suspected cement in a glass of water, and stir with a bar magnet of fair strength. On examination, the pole of the magnet will be found more or less covered with minute sparkling particles of steel or iron, easily distinguishable under an ordinary pocket magnifying glass, and there will also be seen minute balls or agglomerations of magnetic material of a nondescript character, which nothing but slag ever contains. If a solution of the cement with hydro-chloric acid be made, there will usually be some insoluble residue; also, a strong odor of sulphuretted hydrogen, betraying compounds of sulphur of a possible dangerous character when exposed to the air; carbonate of lime, as betrayed by effervescence, may be present or absent. The presence of phosphorus, another element of basic slag, may be ascertained by the molybdate method as laid down in the publications of the official agricultural chemists, and noting a yellow precipitation. Bulletin 46, Chem. div. U. S. Dept. Agriculture.

We have one sidewalk laid about fifteen months ago, using a German Portland cement of high reputation and corresponding price, besides sustaining a high physical test, which lasted about ten months before showing signs of cracking, and is now in an active stage of progressive disintegration. Securing some fragments of the top course, I had the foregoing tests made for slag, and in spite of the admixture with sand which had been made in laying the walk, all the characteristic reactions were obtained except the odor of sulphuretted hydrogen, which might be accounted for by the total change of the sulphides in that length of time. On crushing the mixture and testing with the magnet, we were still able to extract bright metallic steel, though much of what was originally there had evidently been oxidized. Carbonate of lime was present in force, also the sulphate of lime, and phosphoric acid. In fact, if we had continued farther, we should doubtless have found that if there were anything in the world that ought not to be in a cement, it would be found in that cement. It has been said that the Germans waste nothing; if their slag is high in phosphorus, they make a fertilizer; that which is low in phosphorus they use in cements.

However the doctors like it, there is very little satisfaction to an engineer in holding a post-mortem, but the result of this one on the defunct sidewalk in question might be stated in this form:

Dissolution caused by excess of free lime contributed by basic slag adulteration, but concealed and true prognosis prevented by the presence of calcic sulphate, complicated with ferric oxide, various sulphides, phosphorus and other undiscovered components of blast furnace slag.

It is no doubt a legitimate business to engage in the manufacture of slag cements; but to use the same as an adulterant is false and fraudulent and full of danger to the user in his work.

So far, the season has been too busy to afford much time to be spent on these matters; but a collection has been made of various samples, briquettes of different ages, etc., and we hope that much information may result from more thorough and leisurely examinations that will be of much benefit to the controllers of public works, and by developing methods for practical use will supplement the present standard of tests in the direction in which this standard now fails. But it will be, I believe, of greater benefit if this investigation be undertaken by a number of laboratories, totally disconnected from any manufacturing influences, whereby one may supplement another, errors be mutually corrected, and the increase

of knowledge by the competition of mind with mind be fully obtained.

Until this be done, I think we may all join in the sentiment of a cement expert, who remarked that the more he learned about cements, the less he was willing to swear to.

CREOSOTED WOOD BLOCK PAVEMENTS IN INDIANAPOLIS.

By M. A. Downing, President Board of Public Works of Indianapolis.

Before, and when, I became a member of the Board of Public Works a number of years ago we often had property owners say, "Why can't we have such wood pavements as we see in Paris, London and other European cities? They seem to be so much cleaner and quieter than asphalt or stone." They insisted that there was a fine dust, a glare, a noise and heat that were positive discomforts, which they could escape to a great extent if they could have a wood pavement, and if we could give them a durable wood pavement they wanted it, and many wanted the wood without conditions, and many petitions for it were presented.

A careful study of wood pavements in this country and Europe followed. There can be no doubt that the consensus of opinion in this country is that the wood block pavement as commonly known has not been a success. It seems strange that the glaring defects—one might almost say the kindergarten defects—of those pavements had not been noted and eliminated, but they were not, and millions of square yards of wooden block pavement have been laid and are yet being laid, the only foundation for which is plank laid on sand. The blocks were cut from round, green cedar posts, with the sap-wood left on, and in some instances the bark. These blocks, without further preparation, were laid on boards, some gravel tamped into the joints and covered with coal tar. It would seem almost absurd to call such a structure a pavement. In saying this, I am not forgetting the Nicholson pavement, the principal defect of which was the lack of suitable wood. It seems to me that all the ingenuity and inventive genius of that time was exercised along the line of discovering some odd or novel way to cut and lay the blocks, or to bind and lock them together. As far as I have been able to discover, these things were of little avail. The cardinal defects were:

First. Failure to select wood with sufficient strength and toughness to withstand the loads and abrasion, and

Second. The total absence of any attempt to create conditions to prevent the rotting of the blocks.

Just why it was considered necessary to select white pine and cedar when the country abounded in the harder and stronger woods it would be difficult to conjecture, but the fact remains.

And why no adequate effort was made to properly season and treat the wood I leave to engineers to answer. It may have been because it was a new field and explorers are scarce. Certain it is that if any architect had attempted to build a house of such material treated in the same way he would have been severely criticised by his professional brethren, to say the least.

As a result of our studies of wood pavements, we decided to require the concrete foundation in every instance. We first laid Washington red cedar, rectangular blocks without treatment of any kind. This wood was very soft and porous. It was practically the Nicholson pavement. The blocks were laid close together on a one-inch cushion of sand over the concrete. Two heavy traffic resident streets were laid in this way and they are now in their fifth year; both are considerably worn on account of the softness of the blocks, while here and there rotted blocks are visible. Washington red cedar was still in the specifications when I became a member of the Board of Public Works. A provision was inserted providing for creosoting, but the specifications were indefinite. The following spring and summer, 1896, four streets were paved with creosoted (about three pounds of oil to the cubic foot of wood) Washington red cedar. These blocks were 4 inches wide and 5 inches with the grain of the wood. The blocks were laid in rows at an angle of 45 degrees with the curb. All of these pavements are in excellent condition at this time, and on parts of them the traffic is heavy. No provision was made for expansion, the blocks were driven as close together as could be with a sledge and the joints filled as far as could be with paving pitch. We have had some trouble caused by the blocks bulging. Most of this was on streets where the blocks were not creosoted, but we have had a few cases where the blocks bulged on the streets last mentioned, but nothing serious. The specifications were then changed, providing for the heartwood of the long leaf southern yellow pine, with the blocks 4 inches wide, 4 inches deep with the grain of the wood, and impregnated with ten pounds of the best quality of creosote oil. These blocks were laid in the manner above described, except that a space of from 1 to 2 inches (according to the width of the streets) was left between the curb and the blocks for expansion. This space was filled with dry

sand and covered over with heated paving pitch. The interstices were partly filled with fine, dry sand and the street surface rolled to a smooth surface before covering with heated paving pitch and top dressing with fine gravel or screenings. In no instance have we had any trouble on any of these streets from the blocks bulging. The surface of these streets is as smooth as a floor, and has a soft brown color that is restful to the eye. Under the heaviest traffic no wear is as yet noticeable and the streets are in perfect condition. The oldest is about three years old. It appears that the dirt on these pavements does not grind into such fine dust as it does on the asphalt and consequently is not as unsanitary nor annoying. The cost of cleaning is less than brick or asphalt, for the reason that we do not have to clean as often. We often hear complaints of the heat that comes from the asphalt on hot days. This does not seem to be common to the wood, but the one quality that seems to be preeminent is noiselessness. I think that people pay more attention to this quality, of late years, than they used to; in fact, they now often demand it, whereas, when I was a younger man, people would speak of it as desirable, but were not willing to be assessed anything extra on that account. We feel that the creosoted wood block pavement is a success from every point of view. We believe that, constructed of the material we are using (or other strong woods, like beech, tamarack, red or yellow fir), properly creosoted, using first-class quality of creosote without adulteration, that the pavement is more durable than asphalt and brick and nearly as durable as granite. It certainly has met with an enthusiastic reception in this city, as is testified to by the great demand for it. We have contracted for about three times as much of it this year as we have for asphalt. There is practically no demand for stone or brick in this city except for alleys.

We have not adopted the European method of spacing the blocks from a quarter to a half inch apart and filling them with Portland cement grout, but I am not sure that their practice is not preferable. We have found up to this time that our present practice is good, and our engineer hesitates to depart rom it, although I must say that when the blocks are driven so close together it is next to impossible to get any filler in the joints. This may cause swelling later, although I hardly think so.

We have thus far not followed the common European practice of making the surface of the concrete perfectly smooth and laying the blocks directly thereon, but have introduced the one-inch cushion of sand. But if we are called upon to pave heavy traffic streets we will probably do so, as experience in both London and Paris has shown that the practice has been successful, as the Rue de Rivoli, over which passes 42,000 vehicles per day, and King William street, the heaviest in London, are both paved with wood in that way. Few people understand the efficacy of creosoting; why the wood seems harder, tougher and more durable. It is simple: Wood dried to 10 per cent. moisture has about double the power to resist crushing and abrasion that it has if very wet. In creosoting, the sap and moisture are removed and the heavy oil (creosote) which repels moisture becomes encysted in the fiber of the wood. When snow and rain lie on the pavement, they may get to some extent into the cells, but not to any great extent into the fiber, because it cannot displace the oil; hence the fiber remains dry, and, of course, retains its strength. The uncreosoted wood pavements wear doubly as much in wet weather as they do in dry weather. This is not true of the creosoted wood pavements for the reasons above given.

I might say a word in regard to cost. This would probably vary according to the distance the blocks would have to be freighted. The pavement laid with long leaf yellow pine blocks, 4 inches deep, treated with ten pounds of the best quality of creosote oil per cubic foot of wood, laid on a concrete foundation complete, and guaranteed for from five to nine years, has cost us from $2.10 to $2.50 per square yard.

SPECIAL ASSESSMENTS.

By George T. Bouton, of Jersey City, N. J.

We will doubtless agree that, as an abstract proposition, all assessments for public improvements should in law and equity be based on the benefits accruing to real estate by reason of the making of a certain improvement, the cost of which improvement should be prorated on the several properties benefited, and to the extent of such benefit; but as public improvements (and I refer to paving and sewer work) cost the same, whether the properties benefited are worth $100 or $1,000 per city lot, the more valuable property would probably be benefited to the full extent of a pro-rate of the entire cost, while to so assess the less valuable property would oftentimes resolve itself into a practical confiscation.

The law which governs our city precludes the making of an assessment beyond the actual benefit derived, and thus at times

the city is compelled to assume a share of cost, because the making of the improvement petitioned for appeals to the governing body as of sufficient general benefit to warrant the expenditure; but experience has taught us that the greatest care should be observed in the exercise of this prerogative, as increasing demands for partial exemption are strengthened with each concession.

I have heard individuals argue for the favorable consideration of a petition for an improvement, the benefits of which would be largely local, and the making of which would result in the city's assuming quite 50 per cent. of the cost, the petitioners admitting that the improvement was not worth its cost, but contending that the balm of increased valuation which time might produce would eventually offset the outlay. I have heard individuals strenuously insist on the making of certain improvements for the reason that their communities would be largely benefited, and after such improvements had been completed and the assessments levied therefor, I have listened to equally strenuous arguments from the same gentlemen in an effort to convince the authorities that the benefits derived were largely general, and that the city at large should assume the whole or greater part of the cost.

Cases have come to my knowledge where petitions comprehended improvements in localities not only very sparsely settled, but where the property was of such little monetary value as to be practically worthless, where the pro rata of the cost of improvement would be about fourfold in excess of the value of the property, and where any accruing benefit to the city would be so greatly remote and prospective that even a superficial examination of the case would warrant a conclusion that the interested property owners desired to gamble at the city's expense and with the city's resources. If the improvement produced exceptional results their gamble would be successful; contrariwise, their stake was a bagatelle.

It is safe to conclude that occasionally all municipal governments have somewhat similar experiences, but incidents such as these should not have a deterring effect in the exercising of a fairly liberal public policy toward property owners. Every improvement contemplated not only benefits the private owner, but adds just so much to the betterment of the city as a city, and the question resolves itself into this: Under what circumstances and to what extent should the city extend financial aid?

While it is obvious that no inflexible rule can be established by the officers of a city government in establishing a maxim percentage of cost to be borne by the city at large, it is likewise obvious that in the removal of eyesores, in the correction of evils which for a long time have asserted themselves, and in the doing of a work which is part of and necessary to a whole, and which would be impossible of accomplishment without municipal aid, a greater ratio of liberality should be extended.

Up to the year 1895 the improvement laws of the city of Jersey City were cumbersome and the expense incident to the making of an improvement was considerable of a factor in the total cost, the natural result being that comparatively few improvements were petitioned for. With the securing of new and more liberal laws an appreciable reduction in the expenses theretofore incident, and the pursuance of a more liberal policy toward property owners, more has been accomplished in our city during the past five years than is the sum total of the showing for the twenty years preceding, while the percentage of payment for assessments levied has kept pace with our expectations. Not 1 per cent. of the property owners assessed has complained of unequal or excessive assessment, and as the result of the policy established the city has been vastly improved and beautified, her ratables appreciably increased and her ability to hold her own with the advanced and advancing cities of America rendered indisputable.

A liberal policy, however, cannot be successfully maintained without the exercise of great care, exceeding watchfulness and sound judgment. Officials must be deaf to every claim for partial exemption where the city does not receive an offsetting compensation; blind to every insistment for special favor in which there is nothing of benefit for the municipality; resistent to every demand for something of questionable utility, else that which would otherwise prove a blessing to a community must result in the discontent of the tax-payers, in a corresponding lack of general interest, in loss of local pride, and in the building of a monument of debt, to reduce which processes of law must be largely resorted to.

PAVEMENTS BETWEEN STREET RAILWAY TRACKS.

By C. H. Rust, City Engineer, Toronto.

In 1891 the exclusive privilege of operating the street railways in the city of Toronto, for a period of thirty years, was disposed of to a company now known as the Toronto Railway Company. The clauses of the agreement, made between the city and the company, that refer more particularly to this paper, read as follows:

"The purchaser shall maintain the ties, stringers, rails, turn-outs, curves, etc., in a state of thorough efficiency and to the satisfaction of the City Engineer, and shall

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remove, renew or replace the same as circumstances may require, and as the City Engineer may direct. When a street upon which tracks are now laid is to be paved in a permanent manner, on concrete or other like foundation, then the purchaser shall remove present tracks and sub-structures and replace the same, according to the best modern practice, by improved rails, points and sub-structures of such description as may be determined upon by the City Engineer as most suitable for the purpose, and for the comfortable and safe use of the highway by those using vehicles thereon, and all changes in the present rails, tracks and roadbed, construction of new lines or additions to present ones, shall be done under the supervision of the City Engineer and to his satisfaction.

"(A). In the event of the purchaser desiring to make any repairs or alterations to the ties, stringers, rails, turn-outs, curves, etc., on paved streets, the purchaser shall repave the portion of the roadbed so torn up at his own expense.

"11. When the purchaser desires or is required to change any existing tracks or sub-structures for the purpose of operating by electric or other motive power, approved by the City Engineer and confirmed by the Council, the city will lay down a permanent pavement in conjunction therewith upon the track allowance (as herein defined) to be occupied by such new tracks and sub-structures. This shall first apply only to existing main lines and thereafter to branch lines or extensions of main lines and branches, as and when the City Engineer may from time to time recommend and the City Council may direct and require; but such tracks as are now laid on a permanently formed roadway must, when so required as aforesaid, be changed by the purchaser as hereinbefore provided, without any change of roadbed being made or any expense occasioned to the city thereby."

Under the terms of the agreement the company pays the city treasurer $1,600 per annum per mile of double track and 8 per cent. of the gross receipts. When the receipts exceed $1,000,000, 10 per cent. is to be paid.

To raise the money for constructing these permanent pavements debentures were issued, payable in ten years, and the revenue derived from the mileage and percentage of gross receipts is used to pay interest and sinking fund upon these, the total amount of bonds issued up to the present time being $1,210,776 and the annual payment to provide interest and sinking fund is $149,136. This is at present very nearly the amount received from the street railway company, but as these pavements between the tracks will last for a much longer period than ten years, in a few years there should be a considerable revenue derived from this source.

A great diversity of opinion has arisen as to the meaning of the word "permanent," used in connection with pavements. In 1888 this question was in the High Court of Justice before Judge Rose, in a case brought by the corporation of Toronto against the old Toronto street railway company, and after a considerable litigation it was finally settled, without, however, the judge giving his opinion as to the meaning of the word "permanent." When the present company obtained its franchise the interpretation of the word was again subjected to a great deal of discussion, and in 1893 the continuation of the work of changing the rails by

the company and the construction of the pavements were postponed from April until August, pending a settlement as to the meaning of this word. The writer has always taken the ground that in this case the word "permanent" refers to pavements with a concrete foundation, and this has since been taken as the meaning of the word as mentioned in these clauses. It is a great pity that this word should be so frequently used in connection with pavements. It would certainly be well in future cases to state explicitly what is a permanent pavement.

In compliance with the provisions contained in the previously mentioned clauses, in the spring of 1892 plans and specifications for paving the track allowance on King, Queen, Yonge and other streets were prepared, and on the 28th of June, 1892, the street railway company laid down a temporary track on King street, west of Simcoe street, and the contractor for the pavements commenced work. The work of changing the tracks and constructing permanent pavements on the above streets was carried on continuously until winter set in (with the exception of a week's intermission during the time of the Industrial Exposition). The amount of track taken up and relaid this season was 29.9 miles. The method then adopted in paving the track allowance is shown on the sketch attached to this paper. The rail adopted by the company and approved of by the city was a 6½-inch steel girder rail, weighing seventy pounds to the yard, and having a web three-eighths inch in thickness and a base of 4½ inches wide. A slight alteration was afterward made in the size of the base, making it 5 inches instead of 4½ inches. The rail now weighs about seventy-three pounds to the yard. From experience since gained a heavier section of rail should have been used. The following are the quantities of materials and weights required to build one mile of single track:

114,714 tons of seventy-three-pound rails per mile.
5.85 tons of fish plates, seventeen pounds per pair.
1,800 cedar tires.
1 ton of spikes, three-quarters pound each.
1 ton of bolts and nuts, one pound each.

The work of constructing these pavements and the laying of new rails was carried on continuously until the work was practically completed in 1894, there being only a few extensions constructed since. In constructing these new pavements the street railway company took up the old rails, tamped the gravel under the ties, put down new rails and lined and leveled them and the paving contractor did the rest of the work.

It may be of some interest to give the amount of work done in each year, the average cost per lineal foot (the width paved being 15 feet for double track), the average rate of progress per day and the different classes of paving material:

1892—29.9 miles single track cost.....	$322,555 00
1893—26.1 miles single track cost.....	392,030 00
1894— 9.8 miles single track cost.....	116,942 61

Average cost per lineal foot of double track for the different classes of pavement during these years was:

Asphalt	$5 23
Granite	2 43
Brick	4 21
Cedar blocks	3 83

This covers the cost of stone or scoria toothing, but where granite was used the contractor was allowed to relay the blocks that were on the street.

Average amount done per day was:

Asphalt	131 lin. ft. of double track
Granite	56 lin. ft. of double track
Brick	73 lin. ft. of double track
Cedar block.....	96 lin. ft. of double track

In 1894, on McCaul street, the method of construction was slightly altered as to the system of laying the granite or scoria toothing. It was found that when the blocks were laid as headers and stretchers that the water lodged next to the block and assisted in destroying the asphalt. To prevent this it was decided to lay scoria blocks, 4x5x9 inches, parallel to the rail and then lay the asphalt. The practice had been to lay the first six inches of concrete up to the bottom of the rail, then lay the scoria blocks in mortar and finally put in the remainder of the concrete. On this street a change was also made in this respect. The whole of the concrete was put in at once and while still wet scoria blocks were pounded into it and left to consolidate with the concrete before the asphalt was laid down. In any extension constructed since 1895 wooden ties have been dispensed with and steel tie bars, 2x⅜ inches, placed 6 feet apart, are used, the rails being laid on a solid bed of concrete 8 inches in depth by 20 inches wide. This method of construction is much superior to the first type adopted and is largely used in other cities.

After an experience of six years of the different materials used, it is evident that, with the conditions existing in Toronto, asphalt is not a suitable paving material to be used between street railway tracks. After having been down only four years, the asphalt commenced to disintegrate. This was at first more noticeable where the asphalt joined the toothing, but it was not long before the rest of the material between the rails commenced to wear into holes. This was due probably to the following causes:

The lack of proper foundation under the ties, which was shown by the settlement of the rails in several places, the impossibility of properly tamping the asphalt between the toothing and the constant watering of the asphalt, rendered necessary by the dust caused by the passage of the cars, and also by climatic conditions. Upon King street, which was the only asphalt pave-

ment laid without toothing, a rut was soon formed, rendering necessary constant repairs. The fact of the lip of the rail not being quite as high as the head and the gauge of the track being 4 feet 10⅞ inches instead of 4 feet 8½ inches, probably had a great deal to do in forming this rut.

As previously mentioned, the first pavements were laid in 1892 and in 1897 it became necessary to commence tearing up the asphalt and replacing it with granite, scoria or brick, depending upon the amount of travel upon the street. By 1900 all the asphalt between the rails will have been replaced by a more permanent material. Up to the present time seven and one-half miles of this work have been done. As these asphalt pavements were guaranteed for five years, arrangements were made with the contractors whereby they substituted brick for this asphalt, and were paid $1.50 per square yard, but afterward when the guarantee expired the price paid for substituting scoria for asphalt averaged about $2.40 per square yard. This includes taking up the old asphalt and also four inches of concrete. The amount of money spent up to the present time in substituting a more permanent material than asphalt is $137,340.19. In putting in blocks in place of asphalt, the asphalt was first taken off and then the concrete had to be picked out so as to afford room for the blocks, which nately, on most of the streets the conwere bedded on a cushion of sand. Fortucrete was put in between the rails just to a depth of four inches, and it was not a very difficult operation to take this out. Granite is no doubt the most durable material to use between street railway tracks, but owing to the very strong opposition of the cyclists to this material not so much of it was used as the department would have liked, and scoria blocks, imported from England, were used instead. On streets where there was not a great deal of travel, Canadian bricks were used. Cement grout was almost entirely used for this work, although some filling was done with paving pitch; but cement was found to be the most satisfactory. Owing, however, to the impossibility of stopping street car traffic while this work was in progress, it was very difficult for the filling to become properly set. On King street during the past summer, where we were substituting scoria block for the asphalt, a portion of the pavement between the tracks was laid with concrete. It has been down now some two months, but not long enough to know the result.

IS A HOUSE SEWER TRAP ALWAYS NECESSARY?

By Charles B. Ball, M. Am. Soc. C. E., Inspector of Plumbing, Washington, D. C.

The writers who have in recent years discussed drainage and sewerage questions concur in the opinion that liquid domestic wastes must be conducted, as speedily as possible, from the plumbing fixtures in which they are formed, through the house drains and the lateral and main sewers to the outfall of the system.

In order to accomplish this desirable result, the ideal sewage conduit is supposed to have a smooth and impervious surface, few and thin joints, sufficient and uniform gradients, good alignment with easy curves, a size not excessive in its relation to the work performed and to be provided with efficient means of ventilation.

Those engineers who are practiced in the construction of drainage works realize that these conditions are usually but imperfectly fulfilled, yet the desirability of approximating to them so closely as may be is not questioned.

Admitting the validity of these fundamentals of design and comparing approved practice with such standards, we observe at once an anomalous circumstance in the presence in each house sewer line of an intercepting trap, which destroys the ideal conditions by disturbing the course of stream flow, decreasing its velocity, hastening the deposit of suspended matters and preventing a general circulation of air through the sewers and house drains.

Frequent objection is made to this appurtenance by the intelligent plumber, who finds it often obstructed; by the skillful architect, who is unable to fix upon a suitable location for the required air inlet; and by the sewer engineer, who notes with a jealous eye the open ends of hundreds of house soil pipes, rendered unavailable, by the prescribed construction, for the ventilation of the public system.

While the present writer must not be understood as advocating the universal abolition of the main trap, it is his object to determine more fully the grounds on which it is stated to be a necessity and to inquire if the omission of this appliance may not sometimes be safely accomplished.

The use of an intercepting trap is based upon the assumption that it is necessary to prevent the intrusion of air from the public sewers to the house piping system and that varying air pressures must necessarily occur in the sewers, which will, if freely admitted to the house lines, endanger the trap seals of plumbing fixtures. While it is unquestionable that the displacement of the air contained in public sewers by the sudden

entrance of storm water is very rapid, and that compression is likely to prevail, it would seem that the most ready means of avoiding damage to the house traps would be to provide ample means for the escape of air at many points, as would be the case were every house trap omitted, rather than to convert the main sewer into a sealed chamber, the air pressure in which must sometimes be sufficient to force the main trap seals. The serious objections to numerous and adequate openings from the public sewers at the street level are well recognized and such a means of securing free communication between street sewers and the outer air has been but rarely supplied.

A second objection to the omission of traps arises from the fear that the obstructing foreign matters now retained by the house trap would otherwise pass to the public sewers and cause stoppages therein. This is a real objection, especially where the separate system is in vogue, but, from the point of view of most sewer designers, would be more than compensated for by the full ventilation of the public system, which would take place if traps were not required.

A third and principal reason for the retention of house traps is, that disease germs may be communicated through the main sewer from an infected house sewer to other house lines. We agree with a recent writer that "the air in sewers may at times be charged with malignant germs of disease," and that the "ventilation of the public system should be affected where the air would be least liable to be inhaled by the public." Is it not true that the least dangerous point for the discharge of such germs is above the house top and not at the ground level?

No authoritative statement as to how far dangers of this nature are real can be made without close observation of the operation and effect upon the public health of systems in which house traps have not been used. Notable examples of this class are found in the towns of Davenport, Ia.; Corning, N. Y., and Newton, Mass. So far as I have been able to learn, no objection is made practically to the operation of the drainage equipment in these towns.

The main and recurring objection is to present practice, the closing of the main sewer and, in many cases, of a considerable portion of the house drain to the most direct and available means for thorough ventilation.

It may be noted that the objection to open connection with these sewers has little force if the plumbing within each house thus connected has tight joints. The present methods of inspections and tests of new plumbing work assure this result in most cities. At all events, the integrity of the plumbing should be above suspicion, whether main traps are provided or not. If the houses are constructed of uniform height, as is usually the case in modern city blocks, or, if they are isolated from each other, as in suburban localities, emanations from the soil pipe openings cannot injuriously affect the occupants of neighboring premises.

In two outlying districts of the city of Washington the concurrence of three conditions, viz., new and clean sewers, recently constructed house plumbing and the separated location of the dwellings, has been thought to justify the omission of the house running traps.

That even more radical opinions than those here expressed are entertained by eminent sanitary authorities is evidenced in a report to the Sewerage Commission of the city of Baltimore, rendered in November, 1896, by Messrs. Rudolph Hering and Samuel M. Gray, from which I quote:

"The problem of sewer ventilation resolves itself into a provision for maintaining a direct communication between the air in the sewers and the atmosphere, and in causing the entrance of pure air, and its circulation through the sewers, to be as free as practicable. The most perfect way to accomplishing the above condition is to ventilate the public sewers through the house drains and soil pipes of the buildings, to omit a main trap along the house sewer, which also acts as a retainer of foul matter, and to have perforations in the manhole covers of the public sewers. In this way an abundance of air can enter the system, not only from the outfall, but through the manhole covers, and circulate through the sewers and out through every private sewer to above the roofs of the buildings. Such a method of ventilation, however, requires that the entire plumbing in the house is planned and constructed by responsible parties, so that the work will be first-class. It is also necessary to have the house pipes tested after the plumbing is finished so as to be assured of tight joints. This method has been tried in several cities in our country and is the common one of the continent of Europe, but it is not the usual one in our country for there is in the minds of many a fear that if the public sewer should be ventilated through the soil pipe of their house some danger might arise, through a leak in their own pipes, of contracting a disease, the germs of which are supposed to come from the public sewers.

"From experience in our country, and in Europe, these fears are not well founded and there are no facts on record to justify them. On the other hand, the advantages of a thorough draft through the house pipes is considerable and keeps them much cleaner than where a trap is placed between the house and the sewer, thus disconnecting the two. It has been said that air coming out of soil pipes below windows of adjoining houses might cause offense, but offense could also be caused if there were a main trap and the house pipes were fouled, which they generally are not when used for ventilating the public sewers."

THE QUESTION DEPARTMENT.

[By Charles Carroll Brown, M. Am. Soc. C. E., for MUNICIPAL ENGINEERING.]

ESSENTIAL CONSIDERATIONS IN FRANCHISES OF STREET RAILWAY COMPANIES.

Can you send me at once anything on the granting of franchises to street railways—any opinions, discussions, etc., on advisability of giving thirty-year franchises? Should it be done? If not, what method or plan whereby the city may reap a benefit.

Frank Hamilton,
Mayor, Traverse City, Mich.

The question of municipal franchises in general is one that has been fruitful of much discussion in many society and other publications. Among books at hand are Frederic W. Speir's "Street Railway System of Philadelphia" (Johns Hopkins Univ., Baltimore, Md.), and A. R. Foote's "Municipal Public Service Industries" (The Other Side Publishing Co., Chicago). A few articles on the subject may be mentioned. In MUNICIPAL ENGINEERING MAGAZINE, "Street Railway Franchises," February, 1899, p. 109; "Ownership of Street Railway Tracks," October, 1898, p. 241; "Municipal or Private Ownership and Control," October, 1899, p. 195. In *Municipal Affairs* (52 William Street, New York), two articles on "Municipal and Private Ownership and Operation of Street Railways," September, 1897. Other articles may be found in the same journal. *Outlook* (N. Y.), vol. 51, p. 600, "Financial Value of Street Railway Franchises." *Canadian Engineer*, February, 1896, "Municipal Control of Street Car, Water and Gas Plants." *Cosmopolitan*, vol. 18, p. 54, "Public Control of Urban Transit." Many articles can be found in government, state and city reports and documents and in the publications of the National Municipal League (Philadelphia), The American Economic Association, American Society of Municipal Improvements, and others. Pages could could be used in giving names of articles on this and allied subjects. Regarding length of franchise, see article on "Street Railway Franchises or Leases" in the editorial department of this number.

STANDARD SANITARY PRACTICE REGARDING SEWER VENTILATION.

Under the above caption your issue of September contains a reply to my inquiry as to the value of trapping the main sewer, and providing a fresh-air inlet.

(1) The main question is, can you always depend on the flush tanks discharging at frequent intervals supplies of water proportionate to the work required?

Granted that in a perfect separate system almost "no sewer gas" is formed, (2) can we say that plumbing is always properly designed and tested in the most thorough manner? (3) Granting further, that the head of the department having in charge the proper care of the sewer system desires to do his duty, can he always depend on his help? House to house inspection, a plumbing board of examiners, the removal of the people's health from local politics may accomplish conditions as suggested in your reply, but we know that politics, backed by the prejudice against the plumber and the general ignorance of the public on this question, rarely ever secures perfect plumbing, drainage and sewer connections.

(4 During summer months residences are frequently closed for weeks, the seal of house traps evaporate and so will the seal of running traps, but is it not best to have sewer air escape at the fresh-air inlet in the yard?

We have a good plumbing ordinance and good inspection law, but when the sewer system was accepted from the contractors the press demanded that all connections be taken out of river and ditches.

Every plumber and drain layer was called into requisition, the above connections were changed from cess-pools, river, ditches and surface bath waste, and connections made to our new system. (5) Many plumbing fixtures had no traps, few any ventilation. Knowing these conditions did exist, would you have advised me to allow any drain connections made without trapping the main sewer and providing a fresh-air inlet?

(6) Even under the most favorable conditions accidents may happen to the main sewer system. Would it not be the safest to shut off the main from the house drain and let city authorities provide the re-

quired ventilation through man-hole and lamp-hole covers, etc.

(7) Vent pipes could be run above the highest buildings, the city could provide vent shafts at the end of laterals. Would this not be safest?

(8) Suppose you have a two-story residence, with outhouse twenty feet or less in the back yard, would you advise a vent on the outhouse for the purpose of venting a public cess-pool, commonly called main sewer?

In conclusion, I am inclined to agree with Mr. A. B. Raymond, Sanitary Engineer, Detroit, Mich., that scientifically sewer air may be harmless, but practically experience does not confirm the verdict, but goes to show that it is an enemy to be feared, hence every precaution should be taken. *E. G. Trueheart, C. E.,*
San Antonio, Tex.

Mr. Trueheart's letter emphasizes the statement in the reply to which he refers, "the true mode of procedure must be worked out for the individual conditions." Definite opinions of the writer on most of the questions asked were expressed in the reply to inquiry in the September number of MUNICIPAL ENGINEERING. In addition (referring to the numbered sentences above) it may be said:

(1) Flush-tanks will work properly if properly taken care of. If they are neglected, or do not exist, it is still possible to do excellent work in cleaning out sewers with water and proper tools. This can be done as often as desired.

(1), (2), (3) and (5). Defects in the management of the force having charge of inspection and cleaning of sewers and house drainage systems should not be charged to those systems. It may make modifications of plans of management necessary. It is sometimes advisable to drop out and let matters get into the worst shape possible, so that the people will rise up and demand the best and see that they get it.

(4) Certainly, if that could be depended upon. Why call it an *inlet* in such case? Unfortunately a slight difference in temperature in the right direction will draw the sewer air into the house and the fresh air inlet will act as its name indicates, diluting the sewer air to some extent.

(5) and (8) are cases to "be worked out for the individual conditions."

(6) and (7). Perforated man-hole and lamp-hole covers are very good so far as they go, and should be insisted upon. They will soon announce filthy sewers and demand attention to them. Vent shafts are exceedingly expensive if in sufficient numbers to be effective to a reasonable extent. The proposition to use the house drains as vent shafts arose from the evident economy of using shafts already constructed.

The main question is clean sewers. If they can be maintained the question of running trap on house connection is of no importance, except that its presence introduces an additional inducement to stoppages. If the sewers must be filthy (*e. g.*, the old sewers in Albany, N. Y., and many other places) the more safeguards the house systems possess the better, provided they do not induce a feeling of security which is not justified by the facts. Bad plumbing may cause much sewer air to be formed in the house system, and a trap in the house connection is then no protection to the house.

USE OF WOOD PIPE FOR WATER MAINS.

1. Please give us the names of parties who make wood pipe.
2. Please give us the names of parties who use wood pipe.
3. Do you think same worthy of use; that is, do you think it will pay?
4. What is it used for and where?
5. What sizes are made, and what is the thickness of the wood?

6. What pressure will it stand in ordinary and in extraordinary cases?
7. How are the joints connected, and do they use iron bands around the pipe?
8. Of what kind of wood are these pipes made?
9. What is the life of wood pipe, and where is it the greatest, under the ground, under water, or exposed to the air, heat and sun?
10. Where will the wood pipe last the longest, in clay, gravel or a mixed strata?

Yours truly,
Sunbury Water Company, Sunbury, Pa.

1. Michigan Pipe Co., Bay City, Mich.; Wyckoff Creosoting Co., Williamsport, Pa.

2. Bay City AuSable, Alpena, Grand Haven, Grand Rapids, Ionia and others in Michigan; Parkers Landing, Tioga and others in Pennsylvania; Denver, Colo.; Astoria, Ore.; Ogden, Utah, and many others throughout the country.

3. When properly designed and constructed of good material they give satisfaction. Whether it will pay to use wood will depend upon size of pipe, head, relative price of materials for wood and for iron pipe, character of soil and other local conditions. Wood pipe usually has much less first cost than cast iron.

4. For supply pipes, usually stave pipe, and for distribution both stave and bored pipe. Also special purposes, particularly where metal would be acted upon rapidly by the water or other fluid transported.

5. Any size likely to be desired. The size of bored pipes depends on the size of logs which can be obtained. The thickness of wood varies from 1⅛ to 3 inches, according to diameter of pipe, head of water and design of hoops.

6. Can be designed for any head likely to be desired, up to say 200 feet. Economy suggests moderate heads.

7. Stave pipe is jointless, the staves "breaking joint," the ends of the abutting staves being joined by an inserted plate of steel. Bands of steel are put round the pipe at intervals depending on diameter of pipes and head of water. Wyckoff wooden pipe lengths are joined by a specially turned thimble. Each length is wound with a continuous band of iron.

8. White pine, redwood, yellow fir, or other suitable straight-grained, clear timber.

9. The life of wood pipe if properly designed and constructed is indefinite under the usual conditions. It outlasts wrought iron or riveted pipe, but not cast iron. The iron bands of stave pipe may require renewal in twenty years. The wood, with renewals of defective staves, will last much longer. On the surface a pipe in constant use will probably last forty or fifty years. Under ground, if always in use, and therefore wet, it will never decay, and the wear of the flowing water will be very slight.

10. In clay, mixed strata, gravel, in the order named, clay giving the longer life. Alkali and some other minerals in the soil seem to shorten the life.

LICENSE FEE OF PLUMBERS IN AMERICAN CITIES.

What license fee do the smaller cities and towns in your conntry charge the plumbers before they can work in connection with the water-works plant?

G. F. Williamson, Supt. W. W., Orangeville, Ont.

Few charge a license fee. Some require a deposit of $10 and a few charge an annual fee of $1 to $25 a year. Nearly all require a bond for faithful performance of work and for payment of fines, fees and other charges. The popular amounts for this bond are $1,000 and $2,000. A few name no amount, making it cover any amounts likely to become due from

the plumber, and others insert $200, $500 and up to $2,500. Two cities in the south require neither bond nor license fee.

DIRECTIONS FOR STAKING OUT STREET AND SEWER WORK.

What books give directions for staking out street and sewer work?

H. F. Toberen, Defiance, Ohio.

Tolwell's "Sewerage" ($3) gives quite detailed instruction regarding laying out of sewers, duties of inspectors and engineer, methods of measurement and of keeping notes. It also contains many hints on overcoming special difficulties. Byrne's "Highway Construction," his "Inspection of Materials and Workmanship" and Gillespie's "Higher Surveying," chapter on city surveying, give valuable instruction.

MOUNTING AND VARNISHING OF MAPS.

Mr. L. C. Hjorth, city engineer of Neenah, Wis., asks for some details regarding methods and materials for mounting and varnishing maps. The desired information can be found in detail in "Wrinkles and Recipes," published by Munn & Co., New York.

[By C. W. Tooke, Professor of Public Law, University of Illinois, for MUNICIPAL ENGINEERING.]

MAY BOARDS DELEGATE THEIR POWERS TO PROFESSIONAL EXPERTS.

I take the liberty to submit to you a question with regard to the powers of a county board which has the right to select plans for a court-house. The question is whether such a board may employ a professional expert to examine the plans and select the plan to be adopted or several from which alone the board will choose. Just how far will the law permit the board to delegate its powers?

J. H. Royer, Urbana, Ill.

Such a board may not delegate its powers of selection, but it may without question employ a professional adviser to act with it in the examination of the plans or to conduct for it a competition, reserving to the board the actual power of selection. If, for example, the board agrees to submit all plans tendered in competition to such an expert, directing him to throw out all that do not conform to the requirements and to choose from the remainder a certain number to be handed over to the board with his comments and recommendations, no objection can be made by any competitor on the ground that the general powers vested in the board have been thereby abridged or limited. While the board may not bind itself to limit its choice to certain plans recommended by a professional adviser, it may in its discretion select a plan from a number so recommended. (See directly on this point, Cope *v.* Hastings, 38 Atl. R. 720, and Price *v.* Board of Passaic County, 96 Fed. R. 174.)

COMMENT ON CURRENT TOPICS.

Street Railway Franchises or Leases.

A correspondent asks a question on the length of franchise for a street railway, the discussion of the basis of which requires more space than can be spared in the question department.

At present the issue seems to be between municipal ownership and private ownership under the uncontrolled conditions heretofore existing. Unquestionably the franchise period should be the shortest possible under the ordinary form of

contract, so that the benefits of the advances in understanding of the question, which are now making, can be secured as soon as possible.

It is impossible to secure investment in a new system unless sufficient length of term of franchise is granted to make good profits reasonably certain. If the acceptance of a twenty-years' term can be secured, this will be better for the city than a thirty-years' term, and ten years would be better yet.

The city should, however, carefully consider the advantages of municipal control of the financial operations and of the extensions and betterments of service, with proper attention to compensation for the granting of the valuable franchise. Most of the complaints of poor service, of neglect of public rights, arise from the exploiting of the company for the benefit of a few stockholders or officers in control of its operations. A few expansions of the capital stock to conceal the enormous value of the franchise, and manipulations of the market to enable the promoters to unload stock or bonds at a high figure, bring the company to bankruptcy or a receiver, while the operation of the plant is actually bringing in an enormous percentage of profit on the money legitimately invested.

When the road is not brought to bankruptcy it is because those in control are a shade higher in honesty of purpose or are satisfied with the profits distributed through a longer period of time. In either case the public suffers, for all the "water" in the stocks and nearly all over and above the cost of constructing the lines depends for its value upon a franchise which belongs by right to the public, and the profits of which should inure to their benefit. A form of municipal control which shall give the city government the power to prevent such stock manipulations, while permitting legitimate expansion of capital and credit to keep pace with growing business, will largely remove this main source of injustice and robbery. Control of the compensation to the municipality for the franchise, including control of rates for service, must also be assumed. This is necessary because some of the increments of income demand little or no increase in a permanent way and may not call for additional capital, or, on the other hand, misfortunes or loss of business may make the burdens of municipal demands too great, in which case they should be reduced. At the present time capital would be slow to invest in such a plant, because the returns while certain might be slower and there is no opportunity for sudden access of wealth, so that investment in plants under the old conditions would be sought and the present political control of city governments is too dishonest and renders the returns from investments too uncertain to warrant investment where no more than the usual legitimate interest is promised. Probably an expert

state board of municipal control would remove the latter difficulty. Time and (in the meantime) public spirited citizens can remove the former.

Public ownership with lease of the operation of the plant is another proposition worthy of full consideration. It has the advantage of removing the questions of capital from the discussion of terms with the company. The question of repairs and betterments is a fruitful source of misunderstandings and contentions. In the case of a street railway plant there is little of this difficulty and need be none if the roadbed is furnished by the city and the operating plant, except possibly buildings and line wires, is furnished by the lessee. The compensation to the city for the lease may be on a sliding scale depending on the amount of business.

In either of these cases the city's compensation is taken care of and it receives the benefit of the increment in value of franchise due to growth of system. The low rate of interest will demand perfectly safe investment for long time, so that a thirty-years' term would probably be shorter than the lowest limit for a lease.

American Society of Municipal Improvements.

The meeting of this organization in Toronto the first week of October was a most successful gathering of city officials, the report of which occupies so much space in this issue of MUNICIPAL ENGINEERING.

The papers and reports presented were of a high order and fully equal to the standard of excellence established at previous meetings of the association, which has achieved a reputation for honest, earnest, consistent consideration of the various branches of city affairs.

The sessions differ from those of almost all organizations devoted wholly or partially to city affairs, because of the extremely practical manner in which the subjects are presented and discussed. This policy of the association was well expressed by President Lewis in his annual address when he said, "Our conventions have not been used for the exploitation of wild theories of municipal government nor as a means of advertisement for those who have goods to sell or political reputations to achieve."

Although the society has been in existence but five years, it has accomplished many definite results and has been an influential instrument in solving problems of municipal life. Much credit is due the promoters of the society for such results, as they are solid, substantial men of brains and energy who have drawn into their company men of similar character, until now the membership is composed of about eighty cities represented by the brainiest men in the United States and Canada engaged in municipal work. The membership includes all city officers and is not confined to city officials connected with public improvements, while the questions considered include

all matters affecting the municipality. An examination of the proceedings of the society, which are published each year in pamphlet form, reveals a collection of a vast amount of practical information regarding city affairs, not the least of which is contained in the discussions of the several papers. A notable feature has been the detailed information upon various questions compiled, tabulated and published so as to form a permanent, comparative record for the several cities comprising its membership. Among the most important of these tables might be mentioned those containing statistics on electric street lighting, street paving and taxation, while there is now in process of compilation an extensive comparative table relating to methods of city government and legislation. It was also the first society to begin the movement toward securing municipal data upon a uniform basis. The work on this subject has been so effectual that the same question has been taken up for consideration by the American Society of Civil Engineers and it has been brought to the attention of the census department of the national government with some chances for results during the coming census.

The results accomplished in the past by this organization have been extremely gratifying to its friends and highly beneficial to the members, but there still remains a broad field for usefulness, which will probably be fully and completely covered in the future development of the organization.

Municipal Works Commission. Two or three recent instances show the need for some supervision of municipal works in the smaller cities and towns which shall supply the technical knowledge which the officials do not think is necessary, and which the corporations mistakenly think they are unable to pay for. In England all plans for local improvements requiring issuing of bonds or legislative action must be approved by the local government board. In Massachusetts all water supply and sewerage plans must be submitted to the state board of health. In Ohio the same is true so far as their sanitary features are concerned. In New York certain classes of municipalities must submit their sewerage plans to the state board of health. In all these cases a very marked improvement in the character of work is immediately secured. In one state a village desired to put in a sewer for a single street, and to issue bonds to raise the money. Under the law the plans must be approved by the state board of health. An interested citizen drew a line on a small map of the town to indicate the location of the sewer, and sent it to the state board for approval. He was instructed as to the law and the regulations of the board. A sewer commission was then appointed and a local surveyor selected to prepare the plans. His addition was a series of lines giving the

locations of probable sewers, with assumed sizes, but with no levels, profiles or other data. The "plans" were again returned. An employe in the city engineer's office in a neighboring city was secured, and another attempt was made. The problem being a simple one, a satisfactory solution was found on the fourth trial, and a good sewer was constructed on the street where it was needed, which can be used for any extensions or branches desired, and is deep enough and with fall enough to work well. The character of the sewer that would have been constructed without the requirement of expert inspection may be imagined.

In another state the writer was asked for references to books about some important work, as the inquirer was appointed to supervise the construction, but it was new work for him and all the books he had found were too technical for him. In still another he was asked to suggest some books to read on surveying, as the inquirer had the prospect of being appointed city engineer of a city of 10,000 inhabitants. It is such facts as these, and the ignorance of city councils which makes them possible, which add force to the proposition for a state commission on municipal works, which shall be as far removed from politics as possible, with expert engineer, attorney and sanitarian as members, whose tenure of office shall be as long as possible. Such a commission is suggested by those who favor municipal ownership of water-works and other public service industries, as a means of securing technical supervision of construction and plans for operation. The commission is even more loudly demanded by the condition of local streets and sewers and of local bond issues on account of the ignorance of officials and failure to secure competent advice. The frequent changes in officials, especially councilmen, in small towns and the low standard of professional attainment and compensation which they maintain, make improvement from within improbable. A provision that municipal bonds can not be issued except to pay for works whose design and construction is approved by such a board will work a great transformation. A single board can do this work for a whole state at comparatively slight expense, and the result will be a saving of many thousand dollars a year to the smaller municipalities.

Uniform Municipal Reports. The American Society of Municipal Improvements spent some time in the discussion of the report of its Committee on Municipal Data at the Toronto meeting, but does not seem to have reached the root of the matter. Nearly all of the discussion was regarding the collection of municipal data by the United States Census Bureau. Doubtless this was desirable from the fact that the work of that bureau begins so soon, but the fundamental ques-

tion is uniformity in municipal reports. If this could be secured, the collection of data by the census bureau would be a matter of but little difficulty. If it can not be secured, no collection of data will be of very high value, because the present differences in method of keeping accounts and making reports make intelligent comparisons of results from different cities impossible. In the report of the committee this necessity for uniformity is put first, and to give definiteness to the discussions some forms for reports were presented for action by the society, under the expressed belief that the adoption of forms by a body of expert municipal officials like this one would carry weight with other cities, and thus make a beginning in the direction desired. This part of the report seems to have been almost entirely overlooked in the discussion, and the matter passed on to the census bureau, not only without recommendation, but with the suggestion that the forms presented were not entirely satisfactory, and at the same time without suggestion as to what would be satisfactory.

This failure to recognize the opportunity is unfortunate. For a recommendation of forms of report by the recognized experts present at this convention would be accepted not only by other city officials, but also, so far as they are applicable, by the census bureau. The statement of the committee is that the forms presented by it are for municipal reports, and its recommendation is that these forms, as finally modified and adopted by the society, be recommended to the census bureau, so far as that office could use them for its inquiries. Unquestionably that bureau would use only a small part of the information which would find place in a complete municipal report, but the program of the report, if adopted, would insure that the forms used by the census bureau would be in line with the work of the society. The committee asks for modifications and reports its failure to secure individual criticisms of the forms presented, either favorable or unfavorable. A committee on the same subject will be appointed for the ensuing year. It is to be hoped that this committee will continue the work and again present the subject and forms of report for the consideration of the next convention. The work will not be completed until there is a much stronger impetus toward uniformity than has yet been given. And this impetus must be given by the city officials themselves. The many changes in forms and in investigators in the census bureau, from the temporary nature of the office, and the erroneous and useless character of some of the work heretofore done, detract from its influence, so that it has little or no effect upon the methods of accounting in city departments. Shifting the responsibility for the matter upon that bureau will result in failure to secure the end desired, which is, not cen-

sus reports, but uniformity in forms of municipal reports.

Death Rate and Water Supply One objection to the present source of water supply of the city of Youngstown, Ohio, is its polluted condition. The recent expert report on a new supply calls attention to the death rate from typhoid fever, and incidentally shows the healthfulness of the city with the exception of this one disease. The excess of typhoid fever does not show in the general death rate, which is less than the average for the state and for cities of more than 10,000 population. It is also less than the rate of individual cities in the state with over 30,000 population, excepting Canton, Columbus, and Springfield. A comparison of the general death rates, therefore, does not show any trouble. When the typhoid rate is considered, however, there is another story to tell, which is hidden in the above comparison by the less death rate from other causes. Thus the death rate from typhoid fever is sixty-four per cent. greater than that of the state, eighty-six per cent. greater than that of cities over 10,000 and 100 per cent. greater than that of cities over 30,000. Consequently, the percentage of typhoid to all other causes of death is eighty-six per cent., 116 per cent. and 139 per cent. greater, respectively, than the averages for the three classes mentioned.

The number of deaths from typhoid per thousand population is about twice that in the next highest city. The virulence of the disease seems to be increasing also, the percentage of deaths to cases of the disease increasing from 10 to 19 per cent. in three years. About half the cases occur in families using city water and half where well water is used. Of the entire population (about 50,000), 16,000 use the city water. The percentage of cases with city water supplies is thus largely increased. Much of the well water is known to be seriously polluted.

Typhoid fever is generally accepted as the indication of polluted water supply, other sources of the disease being readily traced and removed where they occur. The case against the present supply seems therefore to be unusually strong and prompt action on the new supply will doubtless follow.

The point of interest to other cities is the fact that the death-rate from this cause may be concealed by greater healthfulness in other respects, and the necessity, therefore, of extending the investigation to specific diseases.

Philadelphia Water Supply. The commission appointed last spring to report on the best method of improving the water supply of Philadelphia reports in considerable detail its conclusions, giving reasons for their adoption and for the rejection of other propositions that have been considered. The conclusions conform in general to the opinion so frequently expressed by

the expert advisers of the city and the head of its water department during the progress of the discussion of the subject. In brief, the recommendations are to utilize the present plants as far as possible and to the best advantage, using and abondoning certain described portions, to adopt slow filtration for both Schuylkill and Delaware river water, using present reservoirs for sedimentation and storage of filtered water as far as available, and covering all filters and storage reservoirs. Future enlargements should be from the Delaware river, but meters, the introduction of which is earnestly recommended, will postpone the necessity of large additions to the supply, at least until all the present supply is purified. A significant sentence in this connection is this, "The meter is not proposed to increase the revenue, but to prevent one citizen from depriving another of his rightful share of water." This statement is literally true in Philadelphia. The corresponding statement for most cities would be, "The meter is not proposed to increase the revenue, but to require every citizen to pay his rightful share of the actual cost of furnishing water."

It is to be hoped that Philadelphia's troubles about water supply are nearly over. With a mayor who has the courage of his convictions, and a plan for the improvement of the plant which follows in general the lines of the earnest and honest workers for the city's good throughout the controversy, and has the prestige of three of the most prominent names in sanitary engineering, two of which at least belong to men who have long been thoroughly familiar with the entire problem, it may be that the council will pay sufficient heed to the public opinion which these facts arouse to pass the necessary legislation without the disgraceful accompaniments of former proposed ordinances for promoting schemes to benefit contractors at the expense of the public. The way is nearer clear than it has ever been before.

Flush Tanks and Water Waste.

Another evidence of the great waste possible from flush tanks not properly inspected, and of the small consumption when there is proper co operation between water and sewer departments is given in a paper by the superintendent of the Newport, Ky., waterworks, Mr. George Hornung. He found on investigation that the sixty-five tanks of 250 gallons capacity each were running with a full stream and dumping every thirty minutes, if tight. Fifty-two of the tanks, however, were leaky. The tanks thus used 780,000 gallons a day, costing $6.75 for additional cost of pumping this amount, when 32,500 gallons would be sufficient, with two discharges a day. A few dollars spent in making the tanks tight, and a few hours a week spent in inspecting tanks has saved the city nearly $2,500 a year, formerly spent in pumping the wasted water. As usual, Mr. Hornung has found

the defect to be, not in the flush-tank system or principle, but in the manner of inspection and maintenance, and that the remedy is easy if the sewer and water departments will work together to save money for the city.

The Carter Case.

The case of Captain Carter, who was able to misdirect from one to two million dollars of government funds, largely for his own benefit, during his term of superintendence of improvements in Georgia and Florida, has finally been settled by his fine and imprisonment and discharge from the service. It seems hardly possible that so much could have been done during so long a period of years without detection, under the elaborate system of checks to which expenditures under the war department are subjected. Influence, personal and financial, seems to have been powerful enough to bend the usual forms sufficiently to suit his purposes, and there does not seem to have been any reason for discovery except Mr. Carter's desire to try larger game. He seems to have depended upon his reputation and influence and the *espirit de corps* in his successor to prevent exposure, but he counted without his host when an honest man took up his work, and the case made against him was too strong for even his powerful friends and attorneys to overthrow. There seem to be several morals in the story, not the least of which is the weakness of the machine when a strong personality well aided wishes to impede its action. Why was Captain Carter not transferred to another field as most other officers are? He seems to have stayed at Savannah until he asked to be removed.

CURRENT INFORMATION.

Water Supply at the National Capital.

The report of Col. A. M. Miller on the feasibility and propriety of improving the water supply of Washington will be completed in time for submission to Congress in January. The last session of Congress made provision for two methods, which became laws by presidential approval March 3, 1899. One method has for its object the improvement of the quality of the water by filtration and the other makes provision for an increased supply through the use of the long-abandoned Lydecker tunnel and its auxiliary, the Howard University reservoir. Gen. Wilson, chief of engineers, intrusted the execution of the will of Congress in both matters to Col. A. M. Miller, the engineer in charge of the Washington aqueduct and the water supply system generally. An appropriation of $5,000 was made to "enable the proper officer of the government having charge of the Washington aqueduct and the water supply of the city of Washington to make an investigation of the feasibility and propriety of filtering the water supply of Washington and to submit to congress a full and detailed report thereon." Col. Miller submitted a project, which was approved by Gen. Wilson, for conducting the proposed investigation, as far as the funds will allow, by experiments with the actual filtration of Potomac water as delivered from the present distributing reservoir, and also by a personal examination of filtration plants in other cities of the United States, as well as by documentary study of the systems in operation in various cities in Europe. Two experimental methods of filtration are now in actual operation in connection with the local supply—sand filtration and mechanical filtration. Examinations are being made of the effluent from both filters for bacteriological results and the turbidity, and at the same time technical examinations are made to determine hardness, solids and alkalinity. Daily records of the work of the filters have

been tabulated for final report. Bacteriological examinations of the effluent of both filters have also been made by the Army Medical Museum and other results given to Col. Miller to assist in the consideration of the subject.

Increase of Typhoid in Chicago.

According to the records of the city health department of Chicago about 40 per cent. more people died from typhoid fever in August, 1899, than in the corresponding month of the two preceding years. This is attributed to contamination of the water supply, due chiefly to inefficiency of the pumping plant at Bridgeport.

Several years ago, when the fouling of the city's water supply from the sewage of the river became serious, it was determined as a remedy to turn the current of the river backward. In 1884 a dam was built at Bridgeport between the south branch of the river and the Illinois and Michigan canal, and a large pumping station was erected there to lift the river water over the dam into the canal. It was estimated that a flow of 50,000 cubic feet a minute would create a decided backward current in the river, even during freshets. So a plant having a nominal capacity of 64,000 cubic feet a minute was built and put at work.

When this plant runs at or near its capacity, pumping from 50,000 to 60,000 cubic feet of water a minute out of the river into the canal, the purpose for which the plant is designed is carried out admirably. But with a flow of 35,000 cubic feet or less, almost no current is created in the river, and the least freshet causes a flow toward the lake. Under these stagnant conditions great quantities of sewage collect in the south branch of the river, and when the current is reversed and flows toward the cribs, the water supply is hopelessly contaminated for days. Each time this occurs an epidemic of typhoid fever strikes the city and leaves many deaths in its train.

Mr. J. W. Alvord of the engineering firm of Alvord & Shields, the engineers for the Illinois and Michigan canal, says the Bridgeport pumping plant has been running at only about half its capacity all summer. He blames those in charge of the plant for neglect of duty and thinks that the sanitary district trustees should take charge of the pumping station.

Pennsylvania Law Affecting Electric Light Companies.

The supreme court of Pennsylvania has decided that an electric light company in Pennsylvania is a manufacturing corporation, although it does not belong to the class of corporations which is exempt from taxation on capital stock. The decision grew out of an appeal by the Keystone Electric Light company of Gettysburg. For a long time there were two rival electric light companies in Gettysburg, one of which was finally sold by the sheriff. The property and franchises of the defendant company were purchased by the rival corporation and a reorganization followed under the title of the Keystone Electric Light, Heat and Power company. The attorney-general's department soon after began quo warranto proceedings against the company, alleging that there was no authority for the reorganization of an electric light company on the purchased franchise of a defunct corporation. Judge McPherson, of the Dauphin county court, held that under the act of May 28, 1878, there could be no certificate of organization given to the purchasers at sheriff's sale, because an electric light company was not a manufacturing company. The supreme court holds that Judge McPherson's deductions from previous decisions were correct, but that the Northern Electric Light company case, decided several years ago, and upon which later decisions were based, was an incorrect expression of the law.

Re-Election of Mayor Taggart.

The re-election of the Hon. Thomas Taggart to a third term as mayor of Indianapolis on Oct. 10 is one of the notable events of the year in municipal affairs. In national and state elections the republican majority in Indianapolis is usually in excess of 3,000. Mr. Taggart, as a democratic candidate, was first elected by a majority of over 3,700, in 1897 was re-elected by an increased majority, and at the last election was again re-elected by a majority of 347. The candidacy for a third term was forced upon Mr. Taggart against his personal wishes and over his vigorous protest, as his health has suffered much from the burden he has borne and his private affairs need all his attention. An efficient public servant necessarily incurs the enmity of many whose private interests are not accorded desired advantages, and there was tremendous opposition to Mr. Taggart from dissatisfied and disappointed men of this class, comprising a powerful combination of corporate interests, among the most aggressive of which were the railroad companies, who were particularly aggrieved on account of the support given by the mayor to efforts to bring about track elevation at grade crossings in Indianapolis. An ordinance abolishing grade crossings and requiring track elevation was passed by the Indianapolis council, with the active support of the mayor, in last August, and he has pledged his efforts to the accomplishment of this undertaking. On account of his attitude on this question the railroad representatives threatened to defeat his re-election by 5,000 votes. They unquestionably wield a large power, but the adverse vote which they were able to influence was overcome by the support given him by the people, and his re-election was, under the circumstances, a considerable victory. It has resulted in a

boom for him as the next candidate of his party for governor of Indiana, and, according to present indications, he will receive the nomination without opposition, if he is willing to accept it. As in previous years, the mayor required all city officials holding position by his appointment to tender their resignations, and some changes will be made in the different departments, but no announcements of new appointments have yet been made.

Railroad Tracks in Some Cases Are Not Abutting Property.

The Appellate court decided, Oct. 24, that the Indianapolis & Vincennes railway company is not bound to pay half the cost of paving Kentucky-ave., from Merrill to River-st., in Indianapolis. The pavement is only on one side of the street, the other half being occupied by the railroad tracks. The Capital Paving and Construction company, which laid the pavement, obtained a judgment for $960 against the railway company for its share of the cost, and the railway company appealed. Judge Robinson, in deciding the case, said that the city of Indianapolis has authority, under its charter, to pave one-half of a street, or a roadway, down the center of the street, at the expense of the abutting land owners, provided such pavement is a real improvement of the street at that place. Also, that the question whether a railroad right-of-way is liable to assessment for a street improvement is not an open one, but its liability for such an assessment is fully established by the decision of the Supreme and Appellate courts. Judge Robinson took the ground that the city has no authority under its charter to assess any property for the improvement of a street except land abutting or bordering on the street; that a railroad right-of-way lying wholly within a street cannot properly be said to "abut" on that street.

THOMAS TAGGART,
Mayor of Indianapolis.

Municipal Ownership in Michigan.

The Michigan Municipal League adopted resolutions favoring the municipal ownership of public utilities, including street railroads, and asking for the submission of a constitutional amendment by the next session of the legislature permitting it. Municipal ownership was favored by all of the speakers, and many of the towns reported that it was already in vogue, as far as water and electric lighting is concerned, to the decided advantage of the municipalities.

The Barrett Law Again Sustained.

A decision was rendered Oct. 23 by Judge McClure, in the injunction suit against the town board of Pendleton, Ind., to prevent

the improvement of a street under the Barrett law on the ground that it was unconstitutional. The points in the case were the same that have been claimed in a number of recent cases in the state of Indiana—that to assess the improvement against the property at so much per front foot without reference to benefits or damages was unconstitutional. The attorney for the town board demurred to this, claiming that the board had, in a judicial way, determined the question of benefits and damages. The court sustained the demurrer.

The Superior court at Indianapolis, Ind., rendered a decision Oct. 20 holding that the Barrett law is constitutional. The case in which the decision was rendered was brought about by six property-owners in Irvington, Ind., refusing to pay their assessments for the improvement of Washington-st.

Unique Methods for Fire Protection.

The village of Upper Alton, Ill., was recently given water mains from Alton. The city of Alton then loaned the village an old hose truck. No appropriation could be made for horses, so the village offers a prize of $5 to the first person who shall hitch a team to the cart in case of fire.

A Claim of Private Ownership of Streets.

Suit has been filed against the Vineland water works company by Charles K. Landis, founder of Vineland, N. J., for $20,000 as rental for the use of the streets of the town. Mr. Landis claims that he never deeded the streets of the borough and is therefore the sole owner of them. Charles Keighey & Sons, owners of the water works, have offered to sell the water works plant to the town for $100,000. The council proposed to pay $95,000, and a committee had been appointed to effect a compromise. Although Keighey & Sons scoff at Landis's claim, they say that if he means business he will be fought in the courts.

Bidding on Public Work by the City Engineer.

The city engineer of Toronto, Ontario, regularly bids on public work. At a recent opening of bids he was found to be the lowest on three out of four asphalt paving contracts, all of the brick and macadam paving, and one of the three concrete sidewalk contracts. This has occurred before, always resulting in the contract being awarded to the next highest bidder.

Liability of an Electric Light Company for Damages.

A jury in common pleas court rendered a verdict Oct. 6 awarding Miss Sarah Devlin of Chester, Pa., $2,500 for injuries in a suit against the Beacon Electric Light-company. Her father was awarded $800 for medical attendance and care of the young lady. The plaintiff stepped on the wire of the light company which was lying on the street, and as a result of the shock lost control of a leg and had to give up a school. Her physician says she is permanently injured. The first time the case was heard a verdict was ordered for the defendant, on the ground that no negligence had been shown. The supreme court reversed the ruling, with the above result.

Sterilization of Drinking Water.

A way of sterilizing drinking water by means of peroxide of chlorine has been indicated by the Rivista d'Igiene of Turin. The method is termed the Berge process. Peroxide of chlorine is so powerful a bacteriude that three grammes will sterilize one cubic meter of water at a cost of less than half a centime. One objection is that it is only efficacious in the case of drinking water not very impure. The method has obtained an unanimous vote in its favor from the consulate committee of public hygiene in France, and it has yielded satisfactory results at Ostend and Middelkerke.

Electrolysis in New York.

According to experts electrolysis is causing rapid deterioration in some of the New York elevated railroad structures. As the current is supposed to be carried over the Brooklyn bridge there is some fear expressed that the bridge itself may be undergoing damage. It is believed, however, that any weakening of the bridge sufficient to cause it to give way would be preceded by ample warning.

Chicago's Contemplated Improvements.

In a letter to the council finance committee, October 13, Commissioner L. E. McGann urged the city of Chicago to issue $22,000,000 bonds to make new permanent improvements. Commissioner McGann acted on the suggestion of Mayor Harrison, and will have the support of the Civic Federation in securing the necessary legislation to make it possible to increase the city's bonded indebtedness beyond the present statutory limit. The constitution of the state fixes the limit of municipal indebtedness at 5 per cent. of the assessed valuation of all taxable property within the city limits. Estimating that it would double the assessed valuation, the framers of the new revenue law fixed the limit at 2½ per cent. In order to get the $22,000,000 desired by the city administration the 2½ per cent. limit will have to be raised by the next legislature.

Investigation of Electrolysis at Muncie.

A committee has been appointed at Muncie, Ind., to investigate the subject of electrolysis and to report as to whether or not the street car company shall be held for damage. The committee consists of the

mayor and five councilmen. It has been agreed that the new traction companies coming into the city shall indemnify the city for damage that may be done by electrolysis along their lines.

Domestic Production of Asphaltum and Cement.

The report of the United States Geological Survey for last year shows that the production of cement in the United States increased from 10,989,463 barrels, valued at $8,178,283 in 1897, to 11,968,708 barrels, valued at $9,781,501 in 1898; the production of asphaltum increased from 75,945 tons, valued at $664,632 in 1897, to 76,337 tons, valued at $675,649 in 1898.

Officers of American Society of Civil Engineers.

Nominations have been made for the offices of the American Society of Civil Engineers, which are to be filled at the annual election in January, as follows:

President, John F. Wallace, Chicago; vice-presidents, Rudolph Hering of New York and Alfred Noble of Chicago; treasurer, Joseph M. Knapp of New York; directors, John F. O'Rourke and Henry B. Seaman of New York, Thomas H. Johnson of Pittsburg, Henry B. Richardson of New Orleans, Joseph Ramsey, jr., of St. Louis and George A. Quinlan of Houston.

The Ramapo Water Case.

In an opinion by Judge Addison Brown of the United States district court, Oct. 18, the Ramapo Water company was defeated in its attempt to obtain the valuable franchises and other property of the New York and Westchester Water company, which controls the water supply in the annexed district of New York City. The court continued an injunction restraining the sale of the properties involved until a final adjudication can be obtained.

Requirements as to Paving Contracts in Michigan.

Judge Coolidge has declared void a contract between Benton Harbor, Mich., and the Barber Asphalt Paving company for several thousand yards of asphalt pavement. His decision is based on four reasons: First, the city council, in its annual appropriation of 1898, failed to state the estimated cost of the proposed improvement; second, no grade of Pipestone-st. had been established, hence no legal construction of paving could be done; third, no notice of plat and grade of proposed construction had been issued so that tax-payers could make their objections at some specified meeting of the council; fourth, the contract made with the Barber Asphalt Paving company by the city council is no evidence of the acts required by law. The common council may correct its previous errors, but when such error is the violation of a mandatory provision, the council must of necessity retrace its steps. The curbing has been set and the principal street of the city is torn up for half a mile and is almost impassable.

Use of Salt on Roads.

The application of salt to roadbeds will be tried this winter in New York. It is believed that salt will prevent the top soil from freezing, thus obviating the mud which invariably comes with the thaw. Prof. Burr of Columbia University says of the proposed experiment: "The effect of salt would be to lower the temperature at which the surface soil would freeze. I cannot say that it would prevent the road from freezing in the coldest of winter weather. I hardly believe it would do so. Another effect of salt would be to take up the moisture and so, perhaps, do away with the mud. I should say the experiment is well worth trying. It might be done at nominal cost on a small portion of the road at first to test the matter."

"What about crude petroleum?" he was asked.

"Oil has been used with good effect, I believe, to prevent dust and mud on railways and highways. Sprinkling with crude petroleum would certainly have a tendency to keep out moisture, yet I doubt whether it would make a good winter road for speeding horses. Perhaps it might be worth while to experiment with oil on a short stretch of road, but I think the chances are against the success of the experiment. Salt would be much more likely to produce the desired result, according to my opinion."

Right to Demand a Maintenance Bond from Contractors.

The supreme court handed down a decision, Oct. 8, in the case of Neils Hansom vs. the city of Kansas City, Kas. The plaintiff sought to enjoin the collection of the special tax levied for the payment of the cost of paving James-st., from the Kaw bridge to Central-ave., because the contract was illegal in that it required a maintenance bond from the contractor. The case was first tried before Judge Anderson, of the common pleas court, who decided in favor of the property-owners and granted an injunction against the city. The case was carried to the court of appeals, where Judge Anderson's decision was sustained. The city again appealed, and the supreme court decided in favor of the city. The decision is important, as it settles all doubt as to the city's right to demand a maintenance bond from contractors receiving public work.

An Engineer as an Officer of "Trust and Profit."

The Indiana supreme court rendered a decision Oct. 24 reversing the case of the state of Indiana against William Duncan, an engineer in Lawrenec county, who was appointed to supervise the construction of a

gravel road and to see that the work of the contractors conformed to the plans and specifications. The grand jury indicted him on the charge of having solicited from the contractor who had undertaken to build the road a bribe of $150 to make modifications greatly lessening the amount of work. The indictment was quashed by the circuit court, which held that the gravel road engineer does not hold an office of "trust and profit" in such a sense as to make him liable to indictment for soliciting a bribe. This contention was based on the supposed fact that the law providing for the creation of the office of gravel road superintendent is invalid. Judge Baker, in reversing the judgment, said that, under the constitution, the legislature had ample authority to create the office in question. The appellee having accepted the place, and being an officer de facto, would not be permitted to raise the question as to whether or not he was an officer de jure. "Bribery is an offense against public justice. The essence of it is a prostitution of a public trust, the betrayal of public interests and a debauchment of the public conscience. If one admits the doing of the things that produce these results shall he escape by saying that he had no right to act at all? It would seem passing strange if the consequences of one breach of the law might be evaded by showing that another had been committed."

A Singular Damage Suit Against a Water Company.

Suit has been filed against the Omaha Water company, Omaha, Neb., by Mrs. Elizabeth M. King, asking for $15,000 damages on account of injuries alleged to have been received in a fire at the Patterson-Bressler block on March 21. Mrs. King was attending a lodge session in the building at the time of the fire, which was started, it is alleged, by employes of the defendant company striking matches to read a meter. The matches ignited a pile of rubbish, causing the fire. Other similar suits will be filed.

Technical Meetings.

The Ohio Electric Light association elected officers, Oct. 11, as follows: President, D. L. Gaskell, Greenville; vice-president, W. S. Smith, Toledo; secretary and treasurer, J. Q. Brown, Columbus. The next meeting will be held in Toledo.

The Indiana Municipal league met in Lafayette, Ind., Oct. 12. This was the fourth meeting of the league since its organization at Huntington, Ind., Feb. 16, 1899. At that time there were but eight or nine cities included in the membership. At the meeting held Oct. 12 eighteen cities were represented, and twelve applications were made for membership. The object of the league is to give assistance in the capture of criminals; the adoption of similar ordinances so as to avoid unnecessary expense when their legality is questioned before the courts; the discussion of matters pertaining to city improvements and all matters tending to the bettering of city government. Meetings will be held hereafter on the second Thursday in May and October.

A convention will be held in San Francisco, Cal., Nov. 14, by the California State association for the storage of flood waters for the purpose of considering plans for the storage of the flood waters of the state.

The National Municipal league will hold its seventh national conference for good city government in Columbus, O., Nov. 15 and 16. The president is Mr. James C. Carter and the secretary is C. R. Woodruff, Girard bldg., Philadelphia.

Tests of a Mechanical Filter.

The reports of Prof. John H. Appleton, Dr. Gardner T. Swarts and Mr. Edmund B. Weston, C. E., on the tests of a mechanical filter plant installed by the New York Filter Manufacturing company, for the East Providence Water company, of East Providence, R. I., have been published in pamphlet form. They embrace illustrations of the plant, together with complete data on analyses. Prof. Appleton found that the filters accomplished a decided chemical improvement, that they removed a distinctly weighable amount of the total materials dissolved or suspended in the water, that in almost all cases they removed a portion of the ferric oxide, that they reduced the albuminic oxide, and that generally more than 50 per cent. of the kind of animal or vegetable matter which yields albuminoid ammonia was eliminated, in addition to which practically all of the floating and coloring matters in the original water were removed. The available daily capacity of the filters is given as 500,000 gallons, and the rate of filtration 125,000,000 gallons per acre per 24 hours. Mr. Weston reports the following results from the filtration: 6 per cent. less total solids; 1 per cent. less chlorine; 61 per cent. less ferric oxide; 38 per cent. less albuminic oxide; 29 per cent. less free ammonia; 63 per cent. less albuminoid ammonia; 83 per cent. less color; 20 per cent. increase of hardness. The filtered water was wholly alkaline. The results show that the average number of bacteria found in the filtered water during the time when 1 grain of sulphate of alumina of the standard grade was used was less than 5 per cubic centimetre.

Copies of the report can be obtained from the New York Filter Manufacturing company, 26 Cortland-st., New York City.

Appreciation in California.

Every municipality in the state ought to receive regularly a copy of Municipal Engineering, published at Indianapolis, Ind. So excellent are its contents that we feel

tempted to republish the entire magazine.—From California Municipalities for October. 1899.

It may be added. as a bit of gratifying information, that California has long shown substantial appreciation of Municipal Engineering, as we have a large general circulation in that state as well as throughout the Pacific Coast territory. The generous response which comes to us from California may be taken as substantial encouragement to California Municipalities, which makes a very promising beginning in further development of the field. The contents of the three numbers which have been issued are excellent and the publication shows evidence of much vigor.

Personal Notes.

S. S. Bradford has resigned his position as city surveyor of Fredericksburg, Va.

Thomas Main has been appointed superintendent of water works at Marblehead, Mass.

W. H. Detrick has been appointed instructor in civil engineering at Princeton university.

T. H. James has been appointed city engineer and street superintendent at Santa Monica. Cal.

William A. Murray has been appointed assistant instructor in civil engineering in the University of Maine.

Frank S. Washburn, M. Am. Soc. C. E., has removed his offices from New York to the Cole building, Nashville, Tenn.

Phil H. Weber, C. E., has been elected city engineer at Canton, O., to succeed L. E. Chapin, M. Am. Soc. C. E., resigned.

George J. Rockwell, metallurgist for Fraser & Chalmers of Chicago, has been examining gold mines in Hidalgo, Mexico.

Eugene Wakeman has been appointed superintendent of the Le Roy Gas and Electric Light company at Le Roy, N. Y.

H. Cordes has been appointed superintendent of the Carthage Water company, Carthage, O., to succeed Charles Weisbrot.

Prof. Edward Orton, Ph. D., LL. D., of the Ohio state university, died at his home in Columbus, O., Oct. 16, aged seventy years.

Reginald P. Bolton, M. Am. Soc. C. E., has been appointed consulting engineer to the commissioners of water supply of New York City.

Andrew J. Garett, C. E., has been appointed city surveyor at Plainfield, N. J. Mr. Garett has served as street commissioner for several years.

John R. Miller, formerly city engineer of Toledo, O., died in Denver, Col., Oct. 4, where he had gone to regain his health, aged forty-two years.

William H. Evers has been appointed surveyor of Cuyahoga county, Ohio, to succeed Samuel J. Baker, who died in New York Oct. 4 of muscular rheumatism.

Rudolph Hering has been appointed consulting engineer to the sewerage commission of San Francisco. C. E. Grunsky and Marsden Manson are the other members.

Thomas Stratford has been appointed chief engineer of the boulevards and driveways in the department of parks and of the boroughs of Brooklyn and Queens, New York.

B. W. Wells, superintendent of streets, Boston, Mass., will temporarily assume the duties in the office of water commissioner. John R. Murphy, who held the position, has resigned.

William S. Aldrich, M. Am. Soc. M. E., formerly professor of the University of West Virginia, has been appointed professor of electrical engineering of the University of Illinois at Champaign, Ill.

Prof. A. W. French, formerly assistant professor of civil engineering at Hanover, N. H., has been appointed professor of civil engineering at the Worcester polytechnic institute at Worcester, Mass.

Frank C. Amsbary has resigned his position as superintendent of the Home Water company, at Little Rock, Ark., and has connected himself with the Champaign & Urbana Water company at Champaign, Ill.

O. E. Jacobs of the Massachusetts Institute of Technology and W. H. Freedman of Columbia University have been appointed to fill vacancies in the chemical and electrical departments of the University of Vermont.

Major Willis J. Milner has resigned his position as superintendent and general manager of the Birmingham Water company, Birmingham. Ala. Major Milner has served in this position for about twenty-five years.

Herbert Schneider has been appointed instructor in civil engineering at Lehigh university. Robert M. Wilson of Cornell and Barry MacNutt of Lehigh have been appointed instructors in electrical engineering.

John H. McClintock, civil engineer and land surveyor, has established an office at 57 Fiske Bldg., Boston. Mr. McClintock, who is president and general manager of the American Sewage Disposal company of Boston and New York, will still maintain his old office at 268 Washington-st., Dorchester, Mass.

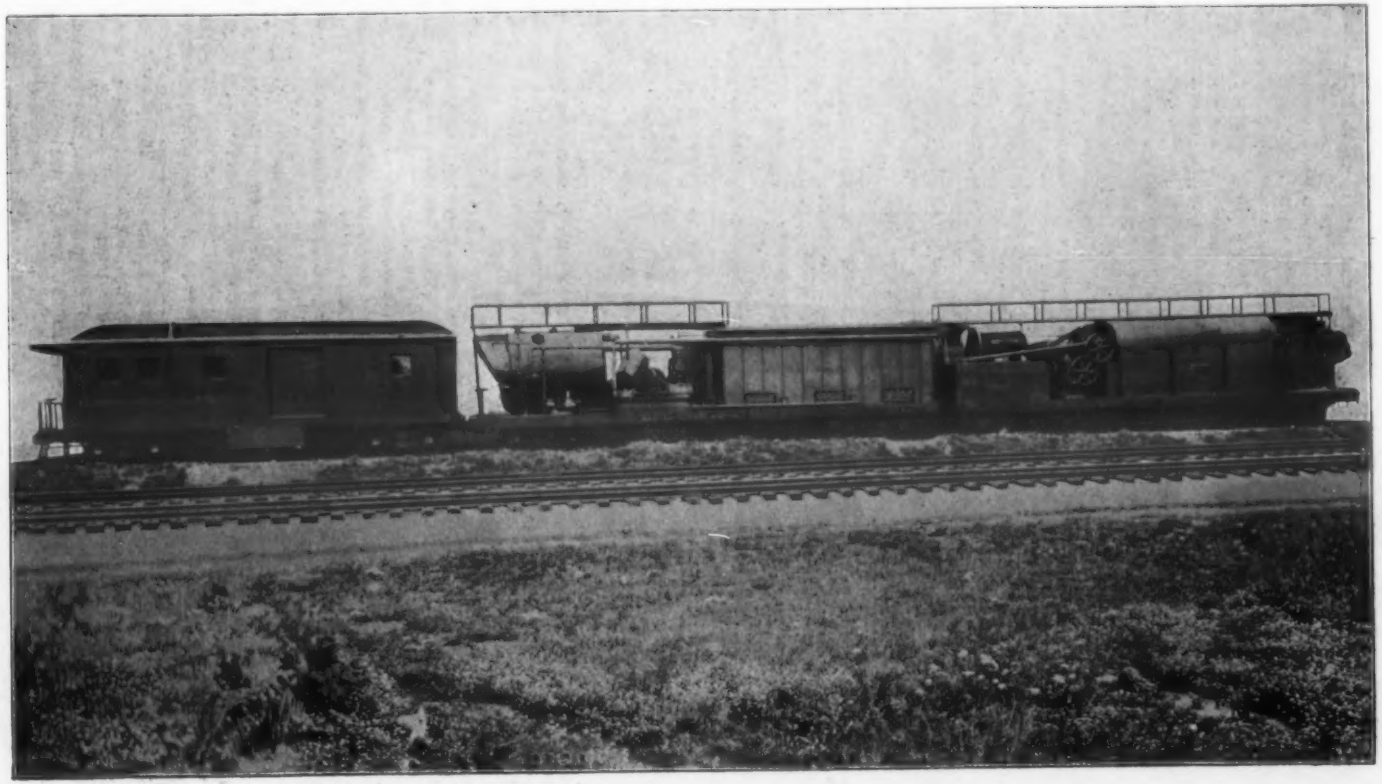
Charles R. Kellermann has been appointed professor of engineering at the University of Alabama, at Tuskaloosa, Ala., to fill the chair of Prof. Wilkins during his absence as expert in the department of transportation and civil engineering, in charge of the United States engineering exhibit at the Paris exposition in 1900.

The appeal of Col. Francis G. Ward to the appellate division from the order of the special term denying his a peremptory writ of mandamus to compel the commissioners of public works to reinstate him as superintendent of the bureau of water at Buffalo, N. Y., was discussed Oct. 13. Col. Ward has an alternative writ requiring the commissioners to show cause why the reinstatement should not be made, and the action will now be brought to trial in court. Col. Ward relinquished the office of superintendent of water bureau a year ago last summer to go to Cuba as lieutenant-colonel of the Twenty-second regiment of volunteers. When he was mustered out and returned he demanded his office again and the board of public works denied the demand. Col. Ward applied to the supreme court for a peremptory writ of mandamus, but the ternative writ. His appeal to the appellate court denied that and granted him an aldivision was lost, but without costs.

MACHINERY AND TRADE.

New Railroad Asphalt Plants.

In the summer of 1898 the Iroquois Iron Works of Buffalo, N. Y., constructed a railroad asphalt plant of a new design and last summer three more plants were constructed, with slight improvements. It is claimed for them that they are the largest plants of this kind that have yet been built. Of the three new plants constructed by the Iroquois company two were for the Warren-Scharf



RAILROAD PLANT FOR ASPHALT PAVEMENTS MADE BY IROQUOIS IRON WORKS.

Asphalt Paving company and one for the Barber Asphalt Paving company. The four plants built by them are now operating at Shelby, O.; Marion, Ind.; Lafayette, Ind., and Kansas City, Mo.

In the construction of the plants the Iroquois company has endeavored to concentrate in two cars all the machinery of a permanent plant and yet, when it is dissembled and packed for shipment, to meet all the railroad requirements in regard to weight and over all dimensions. A photographic view accompanying this article shows the cars packed for shipment together with a box car, which is arranged as an office and tool car. The cars are constructed of 12-inch channels, decked with ¼-inch steel plate, 45 ft. long, 10 ft. wide, with 80,000 lbs. capacity P. R. R. standard trucks. They weigh 36,000 lbs. each and when loaded 112,000 lbs. One car carries the boiler and steam melting tanks for the asphalt, the other the sand dryers and storage bin, the platform carrying the mixer, being extended from the side of the dryer car to span a driveway for the wagons.

The boiler is of the Scotch marine type, 8 ft. diameter 9 ft. long, with two furnaces, 130 lbs. working pressure. The asphalt received in barrels is broken into lumps and hoisted in buckets by a special hoisting engine to the charging holes in three rectangular tanks fitted with steam coils and holding ten tons each. In these it is melted and heated to 320 degrees F. and constantly agitated by compressed air being blown through the material at 15 lbs. pressure. From these tanks asphalt cement flows by gravity to a pneumatic lift, placed under the car, from which it is forced to the bucket on the suspension scale by compressed air, the man at the mixer operating a two way air valve for this purpose.

On the other car the cold sand elevator discharges the sand into two 40-inch drums, 18 feet long, the drums being fired under induced draft. The hot sand, at a temperature of 400 degrees F., is elevated to the rotary screen, from which it is discharged into a steel bin, holding 9 cu. yds., from whence it flows to the 9-cu.-ft. measuring box. The sand and asphalt cement are charged into the steam jacket mixer, which consists of two revolving shafts with blades. These blades are arranged on the screw principle and intimately mix the ingredients to form the pavement, which is discharged into the wagon and goes to the street at a temperature of 320 degrees F.

The output of the plant depends on the time allowed in the mixer, which is the limiting element, and in practice this time varies from a minute tor a minute and a half. Allowing the mix a minute and a half, the maximum output is 350 boxes per day of ten hours; this, converted into square yards of pavement, gives on the average 1,750 of 2-inch topping and 2,275 of 1½ inch.

The new features in these plants are their large size and capacity, use of steam melting tanks and the power transmission, which is simple and direct, the drums and elevators being driven by a 25-H. P. Westinghouse engine, geared direct, and the mixer by a 25-H. P. engine, geared direct, doing away with all belting and counter shafts.

Recent Inventions.

(Reported especially for MUNICIPAL ENGINEERING, by Arthur M. Hood, Indianapolis, Ind. Copies of any patent may be obtained for ten cents.

No. 633,263. Sept. 19, 1899. Surveyor's Instruments. Daniel Grant, Petaluma, Cal. Base board upon which is marked a quadrant scales ulpon its straight sides. Scales are also placed upon two adjacent sides of the board, and movable marking wires extending at right angles to each other and movable across the board, are provided. An angular marking wire is also pivoted at the apex of the quadrant so as to be swung thereabout.

No. 633,296. Sept. 19, 1899. Street Sweeper. A. H. Smith, New York, N. Y. The sweeping is accomplished by the usual angularly arranged rotary brush which delivers the dirt into one of the supporting wheels, which wheel is of such form as to elevate the dirt and deliver it into a chute leading into a box carried by the wagon bed.

No. 633,298. Sept. 19, 1899. Caisson and Method of Sinking Same. W. D. H. Washington, New York, N. Y. The outer shell is provided with a cutting edge and loaded with sufficient weight to sink it upon the removal of a portion of the earth core. An inner lining is then driven in advance to form a coffer-dam and the core is then removed.

No. 633,300. Sept. 19, 1900. Furnace for Burning Refuse. Carl Wegener, Berlin, G. A large cremating furnace provided with peculiarly arranged flues.

No. 633,301. The same. In this is provided a rotating feeding cylinder which is surrounded by an air heating jacket communicating with the inlet in the cylinder.

No. 633,637. Sept. 26, 1899. Machine for Making and Repairing Roads. M. S. Bunnell, Chicago, Ill., assignor to F. C. Austin, same place. A machine of the scraper type with peculiar means for supporting and adjusting the scraper.

Trade Notes.

The Simpson Machinery company, Grand Crossing, Chicago, is enlarging its works.

A cement plant is being built at Iola, Mich., by the Michigan Portland Cement company.

The West Conshohocken Gas Light company of West Conshohocken, Pa., has been incorporated.

The Michigan Alkali company, Wyandotte, Mich., has begun the manufacture of Portland cement.

The Lackawanna Township Electric Light, Heat and Power company, Minooka, Pa., has been incorporated.

The Pana Modern Electric Light and Power and Street Railway company, Pana, Ill., has been incorporated.

The Omega Cement company has begun the building of an office, factory and boarding house at Hanover, Mich.

The Ardmore Electric company, Kansas City, Mo., has filed a statement of increase of capital from $10,000 to $25,000.

The plant of the Lafayette Bridge company, Lafayette, Ind., was destroyed by fire Oct. 7, entailing a loss of $75,000.

A cement mill will be erected on the property of C. Borum at Strasburg, Va., where cement deposits have been discovered.

F. L. Smidth & Co., 66 Maiden Lane, New York City, secured a contract for a $20,000 cement outfit from Sydney, Australia.

The Edison Portland Cement company is

preparing to erect a plant at Stewartsville, N. J. Thomas A. Edison is interested.

The Abbott-Gamble Contracting company, St. Louis, Mo., has established an eastern office in the Times building, New York City.

The Union Electric company of Philadelphia has purchased the plant of the Edison Illuminating company of Williamsport, Pa.

The Crescent White Lime Works, Fayetteville, Ark., has been organized to manufacture cement, lime, etc. W. L. Stucky is interested.

The consolidation of the United Electric Light and Power company and the United Railway & Electric company of Baltimore, Md., is proposed.

The Central Gas Light and Fuel company, Dover, Del., has been incorporated by Edward T. Canby, James L. O'Neill and Gardner W. Kimball of Wilmington.

The Cleveland Portland Cement company has been endeavoring to obtain options on marl lands at Caledonia, N. Y., with a view to establishing a cement plant.

The purchase of a stone crusher is recommended by Mayor Anderson, at La Crosse, Wis. The recommendation has been referred to the street and alley committee.

A syndicate of Lynchburg, Va., has formed a stock company and purchased 100 acres of land near Strasburg Junction, Va., and will erect a large cement plant.

The Toronto Fireclay company, Toronto, O., has purchased lands adjoining those on which their present plant is located and will erect a new brick plant at a cost of about $35,000.

The Catskill Cement company, Catskill, N. Y., has been organized and has purchased 275 acres of clay land to build a Portland cement plant. Jas. W. Kittrell, secy. and treas.

The Cosmo Portland Cement company, Charleston, W. Va., has been incorporated by Thomas Adams, Douglas Heckman, John H. Kauman, John A. Canach and Geo. A. Cook.

The Indiana Portland Cement company, Jersey City, N. J., has been incorporated to manufacture cement. Joel H. Fuller, Frank C. Cain, H. Lindale Smith, incorporators.

The Allen Lime and Cement company, Allentown, Pa., has been incorporated to manufacture cement, lime, etc., by R. S. Rabenold, W. J. Hartzell, F. C. H. Ehwyer, E. Hervey and W. H. Hartzell.

The works of the Pennsylvania Asphalt Paving company, at Torrens-st. and the Pennsylvania R. R., East End, Pittsburg, Pa., was totally destroyed by fire Oct. 10, entailing a loss of $15,000.

The Southern Construction company, Norfolk, Va., has been incorporated. The officers are: John Y. Gossler, president; Charles N. Wire, vice-president; Jesse B. Kimes, secretary and treasurer.

The J. H. Melavin Fire and Mill Supply company, Portland, Me., has been incorporated for fire fighting and automatic sprinkling. J. H. Melavin and James F. Mullin, Cambridgeport, Mass., incorporators.

Seth J. Buckland's iron paving block for converting tram-head girder rails into full groove rails will be used in Springfield, Mass., to the extent of fully a mile on Dwight-st.

The Wayne Construction company, Ft. Wayne, Ind., has been incorporated to manufacture, operate and install electrict railways, water works, electric plants, etc., by J. C. and H. C. Knight and A. M. Rockwell.

The Harper-Norton Paving Brick company, Conneaut, O., shipped its first order, 5,000 brick, to Albion, O., recently. Although this company has only recently started in business, it has proved the excellence of its product.

The B. & O. S. W. road is surveying a side track leading to the proposed location of the cement mills in the eastern part of Bedford, Ind. Prospectors believe that they have found an abundance of good quality of material for cement.

A combination of the seven cement mills in Clark county, Indiana, is proposed as a protection against low prices. The mills are known as the Kentucky and Indiana, Clark, New Albany, Banner, Globe, United States and Standard.

The Loeber Incandescent Light and Heat company, Camden, N. J., has been incorporated to acquire patents for devices for burners, lamps and lighting and heating. The incorporators are Frank M. Wirgman, Frank R. Hansell and Wm. F. Eidell.

Dr. Lane, state geologist of Michigan, has engaged David J. Hale to investigate the marl deposits which are found in a pure and dense condition widely scattered over the state, and in deposits ranging from five acres to thousands of acres in extent.

The Heine Safety Boiler company, which recently purchased the Denittioine Bridge works, is erecting a large plant at Phoenixville, Pa. When completed the plant will consist of three large iron buildings, each more than 100 feet long and 75 feet wide.

The National Building and Supply company, New Orleans, La., received a contract from the city of New Orleans for 60,000 barrels of Portland cement for about $100,000. The cement is to be used in the improvement of the streets of that city.

The American Bridge company, it is reported, will be in operation by Nov. 1. The combine includes thirty-five of the thirty-seven plants in the country, and will control 93 per cent. of the output of the country. The company's headquarters will be in New York.

The New York and Philadelphia company, 243 Washington-st., Jersey City, N. J., has been incorporated to lease and operate gas and electric light and power plants, by Wm. DeH. Washington and Jas. A. Davenport of New York and Wm. D. Kellogg of Elizabeth, N. J.

William G. Hartranft and Joseph W. Zipperlein, Philadelphia, Pa., have severed their connection with the Commercial Wood and Cement company, and have associated themselves together for the purpose of conducting a business similar to that company as distributors of Portland and natural cements.

The storage of 2,500 barrels of cement in one corner of the warehouse of the Peerless Portland Cement company at Union City, Mich., caused that portion of the building to collapse recently. The company is preparing to drain Turtle Lake to recover several thousand acres of land, which, it is believed, is rich in marl.

The Philadelphia Electric company, Camden, N. J., has been incorporated to manufacture gas, oil, electricity, light, etc., by Edwin Hand, jr., J. Newton Fultz and William A. Jolley. The company, it is reported, will absorb the Pennsylvania Heat, Light and Power company and the National Electric company, both of Philadelphia, and ultimately control the electric lighting of that city.

The Wabash Portland Cement company has been incorporated at Indianapolis, Ind. The company has a plant under course of construction in Milford township, Lagrange county, Indiana. The directors of the company, who are from Michigan, are: Albert L. Stevens, Berthune Duffield, Eber W. Cottrell, James H. McMillan, James B. Book and Charles A. Rathbone of Detroit and Emil Stroh of Coldwater. It was known valuable marl deposits existed in Lagrange and Steuben counties along Big and Little Turkey lakes and other lakes in the vicinity, but Mr. Stroh discovered that clay beds of sufficient size and proper quality also abounded. It is claimed that the union of the two substances will produce a cement equal to any imported Portland cement.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

St. Joseph, Mo.—An ordinance has been introduced in the city council prohibiting the sprinkling of asphalt paved streets.

Pontiac, Ill.—The case of the Talbot Paving company vs. the city of Pontiac was denied a rehearing Oct. 3 in the United States circuit court. The city is thus released from all liability.

West Superior, Wis.—This city is preparing to experiment with slate for paving the streets. The slate is found in large deposits within a few miles of this city and the mayor and city engineer believe that the use of the material will solve the problem of acquiring good and permanent streets at a comparatively small cost.

Kansas City, Mo.—The Gilsonite Roofing & Paving company has filed suit against the Rock Creek Asphalt Paving company, the Fidelity & Deposit company and Ambrose Talbot for $17,000. The plaintiffs allege that the Rock Creek company used 1,200 tons of their asphalt to pave Park-ave., between Eighteenth and Thirty-first-sts., and that the other defendants guaranteed payment on it.

Detroit, Mich.—Judge Carpenter has dissolved the injunction by which property-owners on Beaufort-ave. endeavored to restrain the city from paving that thoroughfare north of Gratiot-ave., because there is no sewer in the street. The court finds that there is no likelihood of a sewer ever being built in the street, as the lots on both sides are sufficiently drained into sewers in the alleys.

CONTEMPLATED WORK.

Etna, Pa.—Seitz-st. will be paved with brick.

Norwich, N. Y.—A petition is being circulated to pave N. Bond-st.

Camden, N. J.—Broadway-st., from Kaighn-ave. north will be paved with asphalt.

Pittsburg, Pa.—A boulevard, to run from Allegheny to Sewickley, is proposed.

Clinton, Ill.—A contract will be let soon for brick paving. John Killough, mayor.

Waynesburg, Pa.—Vitrified brick paving is contemplated for Main-st. next spring.

Boulder, Col.—A petition is being circulated for paving Pearl and Fourteenth-sts.

St. Joseph, Mo.—Ordinances were introduced Oct. 9 for paving certain alleys with asphalt

Gloucester, N J.—This town voted Oct. 4 to issue $100,000 street improvement bonds

Aurora, Ill.—LaSalle-st. will be paved with asphalt at an estimated cost of $45,000.

Columbus, O.—The proposed improvement of E. Broad-st. has been postponed until next spring.

Saginaw, Mich.—The question of paving Lapeer-st. with asphalt or brick is being considered.

Peoria, Ill.—The citizens of South Peoria are considering the question of paving S. Adams-st.

Riverhead (L. I.) N. Y.—A macadam road from this town to East Quogue is contemplated.

New Haven, Conn.—Paving is being considered for Chapel-st., from East to Ferry.

Topeka, Kas.—An effort is being made to secure the paving of Tyler-st., from Fifth to Ninth.

Elizabeth, Pa.—Bids will soon be asked for about 3,700 square yards of brick paving on Second-ave.

Hot Springs, Ark.—Mayor Belding is considering plans for paving Central-ave. with asphalt or brick.

Joliet, Ill.—Buell-ave. will be macadamized, $3,868 having been appropriated for that purpose.

East Hartford, Conn.—The selectmen have voted an appropriation of $2,500 to macadamize Governor-st.

Columbia, Tenn.—When the extension of Fourteenth and School-sts. is completed they will be macadamized.

Marion, Ind.—Resolutions have been passed for brick paving in certain alleys. Cyrus G. Robbins, cy. clk.

Washington, Pa.—An ordinance has been passed to pave Locust-ave. with brick. James E. Wilson, ch. burgess.

Wellsburg, W. Va.—The street committee has been authorized to advertise for bids for macadamizing Pleasant-ave.

Taylorsville, Ind.—The tax-payers of Union and Nineveh townships voted Oct. 17 to build twelve miles of pike road.

Owensboro, Ky.—The question of issuing $200,000 street improvement bonds will be voted on in November.

Hopkinsville, Ky.—The question of issuing $200,000 bonds for turnpike purposes will be voted on in November.

Ridley Park, Pa.—The question of issuing $14,000 bonds for permanent street improvements will be voted on Nov. 7.

Niagara Falls, N. Y.—A resolution has been adopted by the board of public works to pave Buffalo-ave. with macadam.

Cortland, N. Y.—The village council decided Oct. 11 to pave Groton-ave., from Main-st. to Otter creek, with asphalt.

Springfield, Ill.—A petition has been circulated providing for asphalt paving for Enos-ave., from Fifth to Sixth-sts.

St. Joseph, Mo.—Buchanan county has been asked to contribute $5,000 toward macadamizing Illinois-ave. in South St. Joseph.

Alton, Ill.—The village board of Upper Alton will pass an ordinace for 2 miles of paving on Garden, Manning and College-aves.

Newark, N. J.—An ordinance was adopted Oct. 15 for paving and repaving Washington-ave. with asphalt or concrete.

San Francisco, Cal.—The superintendent of streets will recommend the paving of Clay-st., between Montgomery and Sansome.

Leavenworth, Kas.—The council has directed the city clerk to advertise for bids for paving the North Esplanade with asphalt.

Bay City, Mich.—The question of issuing $100,000 bonds for the extension of stone roads in this county will be voted on in April.

Cincinnati, O.—The bids for keeping certain streets and alleys in repair were rejected as too high, and new bids will be asked.

Champaign, Ill.—The bids received Oct. 21 for repaving Main and Neil-sts. with brick were rejected and new bids will be advertised for.

Johnstown, N. Y.—An ordinance was adopted Oct. 15 to pave N. Williams-st., from Main to Church, with asphalt. J. E. Burdick, mayor.

Joliet, Ill.—A petition was presented to the board of local improvements Oct. 16 asking that Lincoln-st. be paved with asphalt next spring.

Louisville, Ky.—The granite paving in front of the court house and city hall will be taken up and replaced with asphalt; estimated cost, $15,000.

Glencoe, Ill.—An ordinance is being considered by the council providing that cement walks only shall be laid in the future on Sheridan road.

Kennett Square, Pa.—Bids will be asked soon for macadamizing a portion of West-st. and laying concrete gutters. Dr. H. D. Eutriken, chrmn. st. com.

Jacksonville, Fla.—The work of paving Duval-st. with brick will probably be done in December; estimated cost, $8,767. Philip Prioleau, cy. engr.

Louisville, Ky.—Asphalt paving has been petitioned for Main-st., from Pearl to W. First. A resolution has been passed to pave an alley with brick.

New Orleans, La.—Ordinances have been adopted for paving Camp-st., from Canal to Calliope, with asphalt, and Rampart-st. with Belgian blocks.

Sandusky, O.—North Steeple-st., from Hayes-ave. to Camp-st., about 11,000 sq. yds., will be paved with asphalt on brick next spring. J. W. Miller, cy. engr.

Philadelphia, Pa.—The highway committee recommended Oct. 15 an appropriation of $500,000 for improving streets not occupied by street passenger railways.

Allegheny, Pa.—The question of increasing the bonded indebtedness for paving and curbing Franklin road and paving Oak alley will probably be voted on.

Asbury Park, N. J.—The question of extending the present ocean driveway through Asbury Park and Ocean Grove is being considered. F. L. Ten Broeck, mayor.

Hamden, Conn.—An appropriation of $5,000 was voted Oct. 9 for macadamizing Whitney-ave., from the city line to Davis-st., Whitneysville. E. B. Cooper, town clk.

Boston, Mass.—A highway, known as Shepton-st., will be laid out from Dorchester to Florida-ave. and several streets paved. J. H. Jenkins, secy. bd. st. comrs.

New York City—This city will expend $2,000,000 for repaving the streets in all the boroughs. Bids will be advertised for soon for the work. Com'r. Keating.

Oshkosh, Wis.—The council has decided to pave Main-st., from the bridge to Washington-st. The material has not yet been decided upon. John Mentzen, chrmn. com.

Duluth, Minn.—The board of public works and council are investigating paving materials. About fifteen blocks of paving is contemplated next spring. Thos. F. McGibney.

Buffalo, N. Y.—A resolution declaring intention to pave Forest-ave., from West-ave. to Elmwood, was referred Oct. 19 to a committee of three for consideration.

Philadelphia, Pa.—In its estimates for 1900 the bureau of surveys recommends an appropriation of $3,197,948 for widening Delaware-ave., and for improvements on Pennsylvania-ave.

Carrollton, Mo.—The improvement committee has under consideration the merits of macadam and brick paving, and as soon as a decision is reached bids will be asked.

Camden, N. J.—The council has passed an ordinance requiring the Camden & Suburban Ry. Co. to pave Eighth-st., from Newton-ave. to Line-st., with asphalt, and with brick between the tracks.

Whitman, Mass.—Surveys are being made for macadamizing South-ave. A new macadam road will be built from the high school building to the Consolidated R. R. station. Rd. Comrs.

St. Paul, Minn.—Estimates were submitted to the board of public works Oct. 14 of the cost of paving Rice-st., from College to Front, as follows: Asphalt, $97,596; sandstone, $93,934; brick, $77,455.

Baltimore, Md.—City Commissioner Varney has submitted his estimates for improvements in 1900, in which he recommends appropriations as follows: Repairs to streets, $200,000; sewers, $100,000; bridges, $25,000.

Galveston, Tex.—It is probable that at the meeting of the council, Nov. 6, it will ask the board of public works to prepare plans and advertise for bids for about 9,300 sq. yds. of asphalt paving. R. H. Peek, cy engr.

St. Paul, Minn.—The bids received Oct. 21 for paving Eagle-st., from Third to Franklin, were rejected and new bids will be asked. An ordinance was passed Oct. 11 for brick paving on Ninth-st., from Broadway to Locust.

Woodbury, N. J.—Specifications for a gravel road, from Harrisonville to Mullica Hill, have been approved by the board of freeholders, but it is not probable that they will be approved by State Commissioner Budd before next spring.

Mexico, Mex.—Bids are asked for paving the streets with asphalt and for keeping them in repair. The work will involve an expenditure of $2,000,000. Specifications and other information may be obtained at the office of the Mexican Consulate General, 35 Broadway, New York.

Columbus, O.—Resolutions were adopted Oct. 9 for improving Devoise, Lever and Chestnut-sts. An ordinance was also introduced requiring the street railway company to pave between its rails and one foot outside of them with the same material that is used upon the remaining portion of the street.

Cleveland, O.—John D. Rockefeller has presented to the park board the sum of $225,000 to construct arches and roadways under the Lake Shore railway for the purpose of connecting Gordon park with Rockefeller park, and for roadways and arches under Superior-st. to connect two sections of Rockefeller park.

Peoria, Ill.—Only one bid was received Oct. 16 for asphalt paving on Malvern-st., that of the Warren-Scharf Asphalt company, which bid as follows: Asphalt paving on concrete base, $2.08 a sq. yd.; excavating, 40 cts. a sq. yd.; cement curbing, 85 cts. a lin. ft.; setting protection curb, 8 cts. a lin. ft. The bid was rejected as too high.

Chicago, Ill.—The board of local improvements considers the paving of Halsted-st. with brick a necessity. Dearborn-st., between Madison and Monroe, will be paved with asphalt by private contract. The merchants of State-st., from Lake to Congress, are agitating the question of asphalt paving for that thoroughfare.

Baltimore, Md.—Ordinances for paving have been favorably reported as follows: McCulloch-st., from Fanvale-st. to Lafayette-ave., asphalt block; Chase-st., from Broadway to Wolf, asphalt; Carey-st., from Lexington-st. to Columbia-ave., Belgian blks.; Fort-ave., from B. & O. railroad to Fort McHenry, Belgian blocks. A number of new paving ordinances have been introduced in the First Branch, also.

Worcestor, Mass.—Resolutions have been adopted for paving about 300 ft. of Sever-st., at a cost of about $3,850. Estimates for paving two streets have been submitted by Frederick A. McClure, city engineer, as follows: Main-st., stone blocks, on fand foundation, $28,139, and on concrete, $33,142; asphaltina, $36.442.

CONTRACTS TO BE LET.

Elyria, O.—Bids are desired until Nov. 6 for paving W. Broad and W. Third-sts. W. H. Park, cy. clk.

Marietta, O.—Sealed proposals are asked until Nov. 6 for improving Monroe-st. Carl Becker, cy. clk.

Salem, O.—Sealed proposals will be received until Nov. 6 for grading Evans-st. Geo. Holmes, cy. clk.

Pomeroy, O.—Sealed bids are asked until Nov. 2 for building a sidewalk. Abe A. Massar, cy. clk.

Toledo, O.—Bids are asked until Nov. 13 for block paving on concrete on Detroit-ave. Wm. O. Holst, cy. clk.

Tampico, Mex.—Propositions will be received until Feb. 15 for macadam paving. Neill E. Pressly, U. S. Vice-consul, Tampico.

Lawrence, Kas.—Bids are asked until Nov. 6 for about four blocks of brick paving on Massachusetts-st. A. G. Honnold, cy. clk.

Ewingsville, N. J.—Bids are asked until Nov. 2 for macadaminz 1.3 mls. of Upper Ferry road, in Ewing. J. A. Delp, chrmn.

Hammond, Ind.—Sealed proposals will be received until Nov. 7 for macadamizing and curbing Fayette and Russell-sts. Peter J. Lyons, Cy. C. E.

Cincinnati, O.—Sealed bids are asked until Nov. 3 for macadamizing, curbing, flagging,

etc., on Observatory-ave. Geo. H. Spellmire, clk. B. C. A.

Roanoke, Va.—Bids are desired until Nov. 1 for grading, guttering and macadamizing Third-st., between Salem and Church-aves. J. H. Wingate, cy. engr.

Windsor, Ont.—Sealed bids will be received until Nov. 1 for about 12,000 tons of broken stone for constructing macadam pavements. Stephen Tusted, cy. clk.

McConnellsville, O.—Sealed bids will be received until Nov. 15 for brick paving, stone curbs, etc., on Center-st. L. J. Weber, mayor; Geo. Birch, vil. clk.

Indianapolis, Ind.—Sealed bids are asked until Nov. 1 for grading and graveling three streets and cement sidewalks on six streets. M. A. Downing, chrmn. B. P. W.

San Juan, Porto Rico—Bids are asked until Dec. 23 for building about 18 mls. of roads in the island of Porto Rico. Capt. W. V. L. Judson, U. S. Engr.; prest. B. P. W.

New York City—Bids are asked until Nov. 2 for paving the roads near the botanical museum in Bronx Park, and to furnish trap rock screenings where required on Grand-ave., in Van Cortlandt Park. Dept. Parks.

Cleveland, Tenn.—Sealed proposals will be received until Nov. 11 for constructing about 95 mls. of macadam or gravel roads in Bradley county. J. T. Harle, chrmn. co. rd. comrs.; F. A. Dunham, C. E.; C. Brown, engrs. in charge.

Danville, Ind.—Bids are asked for until Nov. 4 for building cement walks leading to and around the court house, for a broken stone driveway to the court house, and for a retaining curb next to the sidewalk around the public square W. Lewis, chrmn. co. comrs.

Boston, Mass.—Bids are asked for until Nov. 6 for improving Revere-st. as follows: Rock grading, 8,700 sq. yds.; filling material, furnished and placed by contractor, 290,00 sq. yds.; 500-ft. 12-in. drain; 200-ft. 15-in.; 400-ft. 18-in. rubble masonry. Met. Park Comn.

Evansville, Ind.—Bids will be received until Nov. 18 for paving the streets around the court house with asphalt. Bids will also be received on two kinds of gutters—concrete laid on brick as in the original plan, and raising the bricks to form a gutter. City. Surv. Saunders.

CONTRACTS AWARDED.

Kearney, N. J.—The contract for improving Van Emburg-ave. was awarded, Oct. 10, to Robt. H. Orrock.

Merrimac, Mass.—The contract for macadamizing Main-st. was awarded to C. H. Keller of Malden.

Hoboken, N. J.—The Barber Asphalt Paving company secured the contract for paving Palisade-ave. with asphalt.

Coshocton, O.—Adams Bros. were awarded the contract for paving Walnut and Cambridge-sts. with brick, for $23,665.

Farragut, Ia.—The contract for building 1,386 ft. of cement walk was awarded to Frank Burkhard of Shenandoah, Ia.

New York City—The Uvalde Asphalt company secured the contract, Oct. 17, for paving Broome-st. with asphalt, for $8,978.

Sewickley, Pa.—The contract for macadamizing Thorn-st. was awarded, Oct. 4, to McSweeney & Houston, for $16,900.

Minneapolis, Minn.—Canney & Howe secured contracts for paving three alleys with brick, at $1.73 to $1.75 a sq. yd.

Philadelphia, Pa.—Thos. A. Wilson was awarded contracts, Oct. 17, for paving Main and Pearl-sts. with Belgian blocks, at $1.38 a sq. yd.

Hagerstown, Md.—John T. Clarkson has been awarded the contract for 3,300 sq. yds. of brick paving on Summit-ave., at $1.39 a sq. yd.

Grand Forks, N. D.—J. H. Killmar of Des Moines was awarded a contract, Oct. 10, for macadam paving, stone curbing and brick crossing.

Pontiac, Ill.—The Kankakee Artificial Stone company was awarded a contract, Oct. 6, for paving Madison-st., from Main to Chicago-st.

Greenfield, Ind.—The contract for paving East-st., from Main to North, with brick, was awarded, Oct. 11, to C. M. Kirkpatrick, at $1.15 a sq. yd.

Ft. Dodge, Ia.—The Likes Improvement company, Des Moines, was awarded the contract, Oct. 2, for paving First-ave. with brick at $1.38 a sq. yd.

Detroit, Mich.—(Special)—The Warren-Scharf Asphalt Paving company was awarded the contract for paving N. Prospect-st. with asphalt, for $6,655.

Boston, Mass.—The contract for macadamizing 2¼ miles of highway on Revere and Sangus was awarded to Fred E. Ellis of Melrose, for $22,890.

Elmira, N. Y.—Costello & Neagle secured the contract for paving around the freight depot of the D., L. & W. R. R. with granite blocks, for $9,000.

St. Paul, Minn.—Fielding & Shepley were awarded the contract for curbing and boulevarding Iglehart-st., from Wabasha to Lexington-ave., for $21,175.

Rock Island, Ill.—The contract for paving Twenty-second-st. with brick was awarded, Oct. 16, to the Tri-City Construction company of Davenport, Ia.

Omaha, Neb.—The Barber Asphalt company has been awarded the contract for paving Woolworth-ave., from Thirty-second to Thirty-ninth-st., at $2.40 a sq. yd.

Camden, N. J.—The contract for repaving Eighth-st., from Line-st. to Newton-ave., with asphalt, has been awarded to the Vulcanite Paving company at $2.51 a sq. yd.

Morrison, Col.—John Kirby of this city secured the contract for building the stage wagon road along Bear creek, from Morrison to Evergreen, for $6,300.

Utica, N. Y.—The Warren-Scharf Asphalt Paving company was awarded the contract, Oct. 11, for paving the driveway in the rear of the Federal building with brick for $1,225.

Orange, N. J.—The contract for macadamizing, curbing and paving Watchung-ave. was awarded to Daniel J. O'Rourke, and for flagging the sidewalks to Andrew McDevill.

Camden, N. J.—The contract for repaving Delaware-ave. and Federal-st. with Belgian block was awarded, Oct. 12, to the Vulcanite Paving company at 97 cts. a sq. yd.

Kansas City, Mo.—The Barber Asphalt Paving company was awarded the contract for paving Fifteenth-st., from Virginia to Cleveland, with asphalt at $1.85 a sq. yd.

Greenville, O.—The contract for paving and building a sewerage system was awarded to Pfaff, Ringwald & Smith of Chillicothe at a cost aggregating $70,000.

Springfield, Mass.—The contract for paving Walnut-st., from State to Oak, with brick, was awarded to Maloney & Peterson at 90 cts. a sq. yd. The city to furnish the brick.

Jersey City, N. J.—Paving contracts were awarded, Oct. 10, as follows: Improving Broadway, Henry Bern; Clinton-ave., New Jersey Mexican Asphalt company; North-st., Atlantic Alcatraz Asphalt company.

Cumberland, Md.—J. C. McSpadden, Pittsburg, Pa., secured the contract, Oct. 17, for paving N. Mechanic-st., from Bedford-st. to George's Creek railroad crossing, with brick, at a cost of between $9,000 and $20,000.

New Rochelle, N. Y.—Paving contracts have been awarded as follows: Center-ave., block asphalt, Stone & Thurston, New York City, $2.56 a sq. yd.; Rose-st., brick, Abbott-Gamble Construction company, St. Louis, Mo., $2.42 a sq. yd.

Hartford, Conn.—The contract for paving the roadway under the Park-st. R. R. bridge with granite has been awarded to the Hartford Paving and Construction company at $3.35 a sq. yd., the company to keep the pavement in repair for eight months.

Peoria, Ill.—The contract for paving Fredonia-ave. was awarded to J. S. Allen, as follows: Excavation, 22 cts. a cu. yd.; setting protection curb, 5 cts. a lin. ft.; building concrete curb, 35 cts. a lin. ft.; building brick pavement on concrete base, $1.31¾ a sq. yd.

Syracuse, N. Y.—Bids have been submitted for paving S. Salina-st. as follows: Empire Contracting company, asphalt, $33,343.40; Syracuse Improvement company, asphalt or brick, $33,624.70, or Trinadad asphalt, $32,516.90; Asphaltina Construction company, $33,757.90; Warren-Scharf Asphalt company, $33,007.20.

Brooklyn, N. Y.—Paving contracts were awarded Oct. 17 as follows: Asphalt paving, Richmond-st., $19,081, and Vermont-ave., $24,211, Eastern Bermudez Asphalt Paving company, New York City; Sutter-ave., asphalt, Cranford & Co., New York City, $38,074; Logan-st., Belgian blocks, William J. Plant, $24,355.

Boston, Mass.—Contracts have been awarded by the state highway commissioners for road work as follows: Milton, J. S. Lane & Son, Hingham, $8,256; Warren, J. S. Lane & Son, $4,150; Ware and West Brookfield, A. J. Wellington, Boston, $3,248; South Hadley, A. D. Bridge, Hazardville, Conn., $3,965; Cheshire, Polcaro & Ferranti, $7,654; Acton, Adams & Dean, North Adams, $12,743.

Buffalo, N. Y.—Bids were opened Oct. 20 for repaving William-st., from Fillmore-ave. to Metcalf-st., as follows: Barber Asphalt Paving company, asphalt, $4,306; American Contracting company, asphalt, $4,375; German Rock Asphalt and Cement company, Trinidad asphalt, two bids, $4.293 and $5,593; Henry P. Burgard, Alcatraz, $4,441; John Miller, Medina stone, $5,395; Pliny B. McNaughton, stone, $5,260, brick $3,375; John Mumm, brick, $3,950; George Patridge, Medina sandstone, $4,913, brick $3,975; Benjamin F. Spire, brick, $3,800.

Chicago, Ill.—Paving contracts have been awarded as follows: Church-place, brick, M. J. LaBounty, $2.05; Indiana-ave., brick, Gaffney & Long, $1.59; State-st., granite, Chas. L. Kelly, $3.47; Halsted-st., granite, Chas. J. Kelly, $3.19; Halsted-st., brick, Chas. J. Kelly, $1.93; Kinzie-st., Chas. J. Kelly, $3.24; Michigan-st., Dillon & Conlan, $3.23; Michigan-ave., brick, John H. Esson, $1.89; Sheridan drive, macadam, Joseph Bairstow, $2.50; Wood-st., brick, Bermudez Asphalt company, $1.92.

St. Louis, Mo.—The lowest bids received for grading and paving a number of streets and alleys were as follows: Brick, seven alleys, H. Ruecking & Co., about $6,936.90; Sarah-st., St. Louis Stone Masons, Quarry & Bldg. Assos., $11,800; granite blocks, four alleys, Gottleib Eyerman, $5,728; Novaculite, Union boulevard, $28,832.30; granite blocks, alley, Gottleib Eyerman, $456.02; granitoid, alley, Asphalt & Granitoid Construction company, $1,152; grading certain sts., Heman Construction company.

Newark, N. J.—John F. Shanley secured five paving contracts, as follows: Green-st., granite blks., $2.35 a sq. yd.; Elm, S. Thirteenth, Livingston, Charlton and Quitman-sts., asphalt, $1.93 a sq. yd. The Barber Asphalt Paving company was the lowest bidder on four streets, as follows: Burnet and Green and N. Ninth-sts., $1.98; Clifton-ave., $2.07. The board of street and water commissioners passed resolutions Oct. 17 approving 14 contracts with the Barber Asphalt Paving company for asphalt paving, aggregating about $214,000.

Omaha, Neb.—Bids were received Oct. 6 for paving Twenty-eighth-st., from Leavenworth to Pacific, and from Pacific to Poppleton, and Cumming-st., from Fortieth to Forty-second, the lowest bids being as follows: Asphalt, Grant Paving company, $1.98 a sq. yd., each district; brick, John McGowan, $1.85 on first and last district; stone, Hugh Murphy, $2.25 for each district. It is believed that asphalt will be the material selected. A. C. Powers secured the contract for curbing with sawed asphalt stone in the three districts at 67 cts. a ft.

Toledo, O.—Paving contracts have been awarded as follows: Hollywood-ave., any block, $1.35; Vinton-st., Chas. M. McKinney, $1.34; Beason-st., O'Sullivan & Sheehan. The city has decided to allow Contractor Carrigan to proceed with the paving of Orange-st., using Dickman's medal block providing he gives a bond of sufficient size to reimburse the city if any loss occurs. The bond was placed at $10,000. The contract and specifications called for blue granite block, but being unaKble to obtain this brand he asked permission to use Dickman's medal.

Allegheny, Pa.—Paving contracts have been awarded as follows: Old Franklin rd., Ligonier block stone on granite foundation, North Side Coal & Sand company, Allegheny; excava., 40 cts. a cu. yd.; curb, 55 cts. a lin. ft.; crossing, 65 cts. a lin. ft.; brick sidewalk, 68 cts. a cu. yd.; paving, $1.87 a sq. yd.; second-class masonry, $6.75 a cu. yd.; resetting and reconnecting inlets, $12.50; total, $17,840. Oak alley, Booth & Flinn, Pittsburg; exca., 60 cts.; crossing stone, 70 cts.; crossing stone reset, 20 cts.; Ligonier block paving, $1.49; masonry, $4.50; total, $1,642.

Detroit, Mich.—Paving contracts have been awarded as follows: N. Prospect-st., Warren-Scharf Asphalt Paving company, $6,655; asphalt patching, about 500 yards, Barber Asphalt company, $1.95 a sq. yd. Archie Grant was the lowest bidder Oct. 18 for paving Gratiot-ave., from Sheridan-ave. to the city limits. The paving was divided into two sections. Contractor Grant's bid was as follows: 1st section, $18,452.23 with tracks; $24,825.67 without tracks; second section, $17,321.47 with tracks; $23,286.25 without tracks; total, $35,773.70 with tracks and $48,111.92 without tracks.

Lincoln, Neb.—Bids were received for brick repaving in district No. 9, and asphalt repaving in district No. 12. The bids, which were higher than those received in May, were as follows: Asphalt—Barber Asphalt company, $1.80 a sq. yd., 5-yr. guarantee, $2.05 10-yr. guarantee; extra concrete, $5 a cu. yd.; broken stone, $5; sand, 90 cts.; resetting old curb, 12 cts. a lin. ft.; Hugh Murphy, $2.15 10-yr. guar.; extra concrete, $5; broken stone, $2.25; sand, $1; resetting old curb, 15 cts. Brick—J. R. Sheely & Co., Galesburg, brk., sand filler, 1-yr. guar., $1.14½; sand filler, 5-yr. guar., $1.22½; paving cement filler, 1-yr., $1.24½; paving cement filler, 5-yr. guar., $1.32½; Portland cement filler, 1-yr., $1.29½; Portland cement filler, 5-yr., $1.37½; extra concrete, $5.50 a cu. yd.; broken stone, $2.50; sand, 95 cts.; resetting old curb, 15 cts.; W. P. Mamaugh, Iowa brick, sand filler, 1-yr., $1.15; sand filler, 5-yr., $1.23; paving cement filler, 5-yr., $1.25; paving cement filled, 1-yr., $1.29; paving cement filler, 5-yr., $1.39; Portland cement filler, 1-yr., $1.41; Portland cement filler, 5-yr., $1.51; extra concrete, $5.20 a cu. yd.; broken stone, $2.40; sand, $1; resetting old curb, 14 cts. a lin. ft.

SEWERS.

Paterson, N. J.—Mayor Hinchliffe will endeavor to secure the passage of a bill in the legislature that will give power to bond the city for the repair of its sewers.

Chicago, Ill.—An ordinance has been prepared providing that the construction and repair of tunnels, sewers, water mains, catch basins and brick work about fire plugs be done by day labor instead of contract labor.

Philadelphia, Pa.—Michael O'Rourke has begun an action against the city to recover $13,680.50 for work done under a contract for building sewers on the line of Front-st., be-

tween the Phila. & Trenton R. R. and Academy road.

Madison, Wis.—The committee on sewers of the common council recommended, Oct. 17, that the city take charge at once of the sewerage plant for nine months' trial provided in the contract with the American Sanitary Engineering company.

CONTEMPLATED WORK.

Nashua, Ia.—A sewerage system is proposed.

Lansdowne, Pa.—A sewerage system is contemplated.

Gananoque, Ont.—Plans are being prepared for a sewerage system.

Sebring, O.—A sewerage system will be constructed next spring.

Hannibal, Mo.—Surveys are being made for sewers in the Suy district.

Sacramento, Cal.—Bids will probably be asked for soon for a sewer pump.

Ackley, Ia.—A sewerage system is needed, according to local press reports.

Wausau, Wis.—A sewer will built on Callou-st., from First to Third-ave.

Joliet, Ill.—Sewers are contemplated for Pine and Van Buren-sts. Mayor Mount.

Duluth, Minn.—The city engineer is preparing plans for a sewer for West Duluth.

Rockford, Ill.—This city is in need of a comprehensive plan of a sewer system.

Manhattan, Kas.—The question of building a sewerage system is being agitated.

Roscoe, N. Y.—A sewerage system will be built by public subscription, according to press reports.

Lancaster, Cal.—Plans for a sewerage system are being prepared by the city engineer.

Youngstown, O.—A resolution has been passed to build a sewer in Iowa-st. F. C. Brown, cy. clk.

El Paso, Tex.—The question of issuing $20,000 bonds for extending the sewerage system will be voted on.

Perryburg, O.—The council is again considering the question of building a sewerage system.

Tomahawk, Wis.—The estimated cost of a sewerage system is $5,800. D. P. Heath, cy. clk.

Jackson, Mich.—Plans have been prepared for a sewer in Trail-st.; estimated cost, $25,000.

Peabody, Mass.—Better sewerage facilities between this city and Salem are contemplated.

Batavia, O.—The question of improving the sewerage system and streets is urged by Mayor Johnson.

Sedalia, Mo.—A new sewer district, No. 19, including the southeastern part of the city, has been created.

Pensacola, Fla.—The question of issuing bonds for sewers has not been decided upon. F. Glackmeyer, clk.

Lebanon, Ind.—The city council and county commissioners have decided to build a sewer to the creek west of town.

Springfield, Ill.—The construction of a sewer on Fourteenth-st., from Carpenter-st. to Moffort-ave., is contemplated.

Ft. Wayne, Ind.—Surveys for the new intercepting sewer have been completed by Assistant City Engineer Goss.

Alton, Ill.—Objections to the proposed extention of the Langden-st. sewer, from Eighth to Twelfth, will be heard Nov. 4.

Oakland, Ind.—The Commercial Club of this city is making an effort to induce the council to build a sewerage system.

Swissvale, Pa.—The question of issuing bonds for a sewerage system will be voted on in the spring. The plans have been prepared.

Toledo, O.—The city engineer was directed, Oct. 20, to prepare plans for a sewer in Galena-st., from Ontario to Michigan.

Brooklyn, N. Y.—A resolution was adopted, Oct. 12, to construct sewers in the Thirtieth ward, at an estimated cost of $460,000.

Grand Rapids, Ia.—The estimated cost of a trunk sewer with a concrete bottom and top, to take the place of the west side ditch, is $157,000.

Newport, Ark.—Plans and estimates for a sewerage system will be made by S. A. Mitchell, assistant city engineer, Kansas City, Mo.

Sea Isle City, N. J.—The Sea Isle City Sewerage company has been organized, which proposes to build a sewerage system at this place.

Syracuse, N. Y.—Estimates for the West End trunk sewer have been submitted, which are as follows: Web tile, $20,000; brick, $22,400.

Newport, Tenn.—Surveys have been completed by the engineers for the proposed sewerage system, and estimates are now being prepared.

Patton, Pa.—An ordinance has been passed authorizing the construction of a sewerage system. W. C. Hubbard, prest. coun.; Jas. Gilliece, clk.

Bellevue, Pa.—A joint session of the councils of this place, Avalon and Ben Avon resulted in the determination to build a sewerage system.

Los Angeles, Cal.—A petition has been presented to council asking that steps be taken to divert storm water from Alameda-st. Cy. Engr. Olmsted.

Pomona, Cal.—The sewer committee has engaged John Quinton of Los Angeles to act as consulting engineer with regard to a proper location for a sewer farm.

Portsmouth, N. H.—About $12,000 will be appropriated for new sewers. The question of building a sewer to abate the North Pond nuisance is being considered.

North Tonawanda, N. Y.—The question of building sewers in the Ironton district and ten other streets, at an expense of $30,000 will be voted on Nov. 4.

Stratford, Conn.—The question of building a sewerage system is being considered by the committee, Edwin F. Hall, Robert L. Clarkson and Charles E. Stagg.

Normal, Ill.—An ordinance was passed Oct. 20, providing for the construction of a 42-in. brick sewer in Sugar Creek Valley, O.

Denver, Colo.—The board of public works has passed a final resolution and adopted the form of an ordinance for the establishment of the Sixteenth-st. auxiliary sewer district.

Pueblo, Col—The city engineer was instructed, Oct. 9, to make the necessary surveys for sewers in certain alleys. The council will not meet again until Nov. 6. cy. engr. Peach.

The question of issuing bonds for building sewerage systems will be voted on as follows: Elreno, O. T., Nov. 7; Bellefountaine, O., Nov.; El Paso, Tex.; San Francisco, Cal., Dec. 28.

Washington, D. C.—The district commissioners estimate that about $550,000 will be required for new sewers and repairs. This includes $110,000 for a pumping plant for the New Jersey-ave. sewer.

Batavia, N. Y.—The village board of health has condemned the present system of sewerage, and it is probable that the board of alderman will be forced to take some action looking to the establishment of a better system.

New Britain, Conn.—The question of building a sewage filtration plant in Beckley Quarters, and one near Sunset Heights, is under consideration. William H. Cadwell, engr. in charge; A. L. Thompson, cy. clk.

Columbus, O.—The recommendations of Engineer Alvord of Chicago, for sewage disposal, have been adopted. The question of issuing bonds for repairing and completing the sewers will be voted on.

San Francisco, Cal.—Rudolph Hering, New York City, has been engaged as consulting engineer for the proposed sewerage system. The plans have been prepared and the ques-

tion of building the system will be voted on Dec. 28.

Philadelphia, Pa.—The appropriations which will be asked for sewer work in 1900 amount to $500,000. In addition to this $225,000 will be asked for to build a new main relief sewer in the Cohocksink district.

Baltimore, Md.—An appropriation of $100,000 is asked by City Commissioner Varney, in his estimate of expenditures for 1900, to supply the annex with a system of drain pipes; also, $35,000 for the maintenance of sewers.

Newark, N. J.—An ordinance has been passed providing for the construction of a main pipe sewer through Sanford, Clifford and Van Buren-sts., with branch pipe sewers in Delancy, Malvern, Chestnut, Oliver and E. Kinney-sts.

Lakewood, O.—A vote was taken at a recent citizen's meeting approving the proposition to build a combined sewerage system, at an estimated cost of $117,772. The system is advocated by Prof. W. H. Elliott. The vote, which has no legal effect, is merely in the nature of a recommendation.

Baltimore, Md.—In his estimates for 1900 City Commissioner Varney has included the sum of $100,000 for drain pipes in the Annex. An ordinance will be introduced in the council appropriating $20,000 to build a sewer to drain the stagnant water on the lot west of the Mt. Royal-ave. drive to the park at the foot of the Druid lake slope.

Chicago, Ill.—Mayor Harrison decided, Oct. 12, to report all bids for the intercepting sewer, from Thirty-ninth to Seventy-fifth-sts. He will establish a precedent by asking the council to allow the city to do the work by day labor. If his request is not fulfilled, it is understood that the work will not be done by contract during his administration.

Sioux City, Ia.—The plans of City Engineer Lewis for the proposed Perry creek sewer have been indorsed by F. W. Cappelen of Minneapolis. The plans provide for an 18-ft. sewer of brick and concrete, which will intercept Perry creek at certain points. City Engineer Lewis's plans involve an expenditure of $36,115, but Engineer Cappelen advises more expensive construction in several instances than that planned by Engineer Lewis, making his estimate $39,973.92.

CONTRACTS TO BE LET.

Roanoke, Va.—Bids will probably be received until Nov. 4 for sewer work.

Burlington, Ia.—Bids are asked until Nov. 6 for a pipe sewer. Emmet Steece, cy. engr.

Marion, Ind.—Bids are desired until Nov. 7 for building a sewer. Cyrus G. Robbins, cy. clk.

Des Moines, Ia.—Sealed bids are asked until Nov. 6 for a sewer. G. A. Eberhart, chrmn. B. P. W.

Cannelton, Ind.—Sealed proposals will be received until Nov. 4 for a sewer. Robert Stobel, cy. clk.

Chicago, Ill.—Bids are asked until Nov. 15 for furnishing 3,120,000 sewer brick. L. E. McGann, comr. pub. wks.

Bloomfield, N. J.—Bds are desired until Nov. 6 for storm sewers in three streets. John A. Lawrence, chrmn. sewer com.

Glenwood Springs, Col.—Sealed bids are asked until Nov. 6 for 2,300 feet 12 and 8 inch pipe sewers. C. M. Keck, town recdr.

Toledo, O.—Bids are asked until Nov. 20 for building a 10 to 15-in. pipe sewer in several streets. Wm. O. Holst, cy. clk.

Warsaw, Ind.—Sealed bids are asked until Nov. 3 for constructing sewers No. 1, 2, 3, 4, 7, 12, 13 and 30. Robert W. Nelson, cy. clk.

Springfield, O.—Bids are asked until Nov. 6 for a 15-in. pipe sewer on the south side of E. Main-st. Philip Huonker, cy. clk.

Alexandria, Ind.—Sealed proposals are asked until Nov. 3 for building 3-mls. of brick pipe sewers. J. S. Humphrey, cy. C. E.

Cincinnati, O.—Sealed bids will be received until Nov. 3 and 17 for sewers in certain streets. George H. Spellmire, clk. B. of A.

Tampico, Mex.—Propositions will be received until Feb. 15 for building a sewerage and water works system. Neill E. Pressly, United States vice-consul, Tampico.

Sacaton, Ariz.—Bids are asked until Nov. 9 for building a sewerage system at Pima agency. W. A. Jones, com'r. Indian affairs, Washington, D. C.

Cincinnati, O.—Sealed proposals are asked until Nov. 2 for building trunk sewers and drains in State-ave. and Bloody Run. George H. Spellmire, clk. B. of A.

Burlington, Ia.—Sealed bids will be received until Nov. 6 for building a tile sewer in Aetna-st., with branches in certain alleys. Emmet Steece, cy. engr.

Washington, D. C.—Bids will be received until, Nov. 13 for building a sewerage system at Ft. Still, Riverside and Rainy mountain of the Kiowa, O. T. agency. W. R. Jones, comr. Indian affairs, Washington, D. C.

Albany, N. Y.—Sealed bids are asked until Nov. 6 for repairing, cleaning and widening the Fox creek sewer, for enlarging certain receiving basins, and constructing additional storm water inlets. Thomas J. Lanahan, clk.

CONTRACTS AWARDED.

Superior, Wis.—Fritz Henderson submitted the lowest bid for a sewer at $2,226.

Brookline, Mass.—M. J. O'Hearn has been awarded the contract for a sewer for $2,437.

Columbus, Ind.—Earler & Perter secured the contract for building the Mill Race sewer, for $10,044.

Colfax, Wash.—The contract for sewers was awarded to Peter Costello, of Spokane, for $10,636.

Ft. Dodge, Ia.—The contract for a sewer in First-ave., was awarded to C. O. Peterson.

New Kensington, Pa.—The contract for sewers in McGargo-st. was awarded to Angelo Pandolfo.

Knoxville, Tenn.—J. A. Ahler has been awarded the contract for extending the main line of sewers.

Ann Arbor, Mich.—Schneider Bros. presented the lowest bid for building the Huron-st. storm sewer.

Goshen, Ind.—Charles. E. Kutz secured the contract for building a sewer on Douglas and Emerson-sts.

Findlay, O.—Hurley & Hoyle secured the contract for sewers in Blanchard, Center and Cherry-sts., for $3.159.

Sing Sing, N. Y.—The contract for building a sewer in Linden-ave., was awarded to J. L. Sterritt.

Lexington, Mo.—The contract for building sewers was awarded to Ford & Hawkins of Sweet Springs, Mo., $5,480.

Red Bluff, Cal.—The contract for a sewerage system has been awarded to the Pacific construction company, for $29,443.

Charleroi, Pa.—Ott Bros. of Pittsburg, secured the contract for building the sewerage system of this city, for $82,000.

St. Joseph, Mo.—The contract for building a section of the Blacksnake sewer was awarded to Charles H. Nowland, for about $5,000.

Blue Earth, Minn.—The contract for sewer construction, house connections, etc., was awarded to the Heating & Plumbing company, for $3.000.

Troy, N. Y.—The contract for cleaning 218 catch basins was awarded, Oct. 19, to Lawrence Shaughnessy, at $1.24 per catch basin.

Rochester, N. Y.—The contract for constructing sewers in Masseth and Hague-sts.,

has been awarded to Thomas Hollahan, for $17,602.

Portland, Me.—The contract for building 650 feet of 30-in. sewer in Franklin-st., was awarded to Thomas Shannahan, for $3,313.30.

Bayonne, N. J.—The contract for building a sewer through W. Eighteenth-st. has been awarded to Timothy Burke, for $17,602.

Greenville, O.—The contract for a sewerage system and paving has been awarded to Pfaff, Ringwall & Smith of Chillicothe, O., for $70,000.

Wheaton, Minn.—E. I. P. Staed was awarded the contract for about 4,500 feet of 20, 18 and 15-in. sewer, with connections, for about $7,000.

Utica, N. Y.—Sewer contracts were awarded, Oct. 6, as follows: Broad-st., Jas. E. Martin, $1,337.25; Gilbert-st., Joseph. W. Johnston, $1,332.

Billings, Mont.—F. R. Hinds, Butte, Mont., secured the contract for building sewers in the north side of the city for about $25,000.

Cleveland, O.—Sewer contracts have been awarded as follows: Ida-st., Ford P. Beers, $2,752; Woodland and Hills-ave., C. E. Doolittle, $1,078.

Crawfordsville, Ind.—The contract for building the Green-st. sewer was awarded Oct. 19, to McConnell & Lamb of Atchison, Kas., for $8,175.

Marshalltown, Ia.—The contract for building 4,000 feet of 8, 12, and 15-in. pipe sewers, junctions, manholes and catch basins was awarded to J. C. Dunn.

Camden, N. J.—The contract for building sewers on Carpenter and Roberts-sts., was awarded to Aaron Ward, and on Twenty-sixth-st., to B. F. Sweeten & Son.

Estherville, Ia.—Sewer contracts were awarded Oct. 16 as follows: section 1, William Horrabin, Iowa City, $1,499; section 2, John Dows, Armstrong, $1,973.

Nashville, Tenn.—The lowest bids submitted for the extension of sewers, Oct. 12, were as follows: West End sewer, E. F. Lewis, $2,675.90; Market and Jackson-sts., Nashville Plumbing company, $472.48.

Allegheny, Pa.—Sewer contracts have been awarded as follows: main sewer on Brighton road, Jas. Carson and company, Allegheny, $6,985; lateral sewer on Atlantic and Trenton-aves., Lee & Casey, Pittsburg, $1,309.

Wabash, Ind.—Philip Hipskind & Sons secured the contract for 2,210 ft. of 8-in. pipe sewer on Hill-st. at 89 cts. a lin. ft. The work includes five manholes, one catch basin and two flush tanks.

St. Paul, Minn.—Fielding & Shepley secured the contract Oct. 18 for a sewer on Midway-ave. for $435. Anderson & Johnson secured the contracts Oct. 5 for sewers as follows: Magnolia-st., $2,383; Manitoba-ave., $778; Sims-st., $996.

Boston, Mass.—Beckwith & Quackenbush of Herkimer, N. Y., were awarded three contracts Oct. 16 for building sections of the new high level sewer, for the Charles and Neponset river valleys, as follows: Sec. 65, $38,610; sec. 68, $68,843; sec. 69, $86,125.

Bridgeport, Conn.—The contract for building a sewer in Carroll-ave. was awarded Oct. 10 to the Pierce Mfg. company at $1.15 a running foot. The B. D. Pierce, Jr., company secured the contract for the sewer wells at $47 and $49, according to the digging and condition of the soil.

Syracuse, N. Y.—Sewer contracts have been awarded as follows: Wilbur, Tennyson, Bryant, Whittier, Coleridge and Lowell-aves., Thos. Marnell, $7,495.20; Alvord-st., C. T. Hookaway, $495; Seward, Wood, Beecher and Douglas-sts., Davin & Rafferty, $3,185; Emerson-ave., Davin & Rafferty, $1,059.75; Highland-st., web tile, F. J. Baker, $12,432.12.

Zanesville, O.—Bids were received Oct. 21 for a 12-in. sewer in Marble alley and a 24-in. sewer in N. Seventh-st., as follows: Marble alley sewer—J. E. Brown, 52 cents per foot, catch basins $10 each, manholes $25 each; Petit & Abele, 93 cents per foot, catch basins $28 each, manholes $42 each; E. J. Tracy, 86 cents per foot, catch basins $26, manholes, $35.50. North Seventh-st.—E. J. Tracy, $1.50 per foot, catch basins $28.50, manholes $40; Howser Bros., $1.15 per foot, catch basins $20, manholes $30; Petit & Abele, $1.60 per foot, catch basins $33, manholes $38.

WATER-WORKS.

Indianola, Ia.—This place voted, Oct. 16 to grant a franchise to operate the water works plant.

Oskaloosa, Ia.—The council has decided to purchase the water works after certain improvements have been made.

Philadelphia, Pa.—The executive committee of the Allied Water Committees adopted a platform, Oct. 13, favoring filtration and municipal ownership.

Spartanburg, S. C.—John B. Cleveland purchased the works formerly owned by the Spartanburg Water Works company, for $102,800. The works will be improved.

Chicago, Ill.—The Cicero Gas, Water and Electric Light company filed a deed, Oct. 24, transferring its property to the Chicago Suburban Water and Light company, for $1,290,000.

New Orleans, La.—The New Orleans Water Works company filed suit, Oct. 9, against the Drainage Commission for $7,889.90 claimed as damages to petitioners' pipes.

Racine, Wis.—The Racine Water company has filed a suit against the city for $18,610.56, for alleged excessive use of 310,174,080 gallons of water used through the flush tanks for the year ending Nov. 1, 1898, at 6 cents per thousand gallons. This suit is in addition to the one brought to recover $159,153.50 for the use of water through these tanks, amounting to 2,652,558,726 gallons.

Newly incorporated companies: Lowell Land and Water company, Whittier, Cal.; Coalinga Water company, Coalinga, Cal.; Oakland Spring Water company, Oakland, Cal.; Randsburg Water company, Johannesburg, Cal.; White Deer Mountain Water company, Lewisburg, Pa.; Pocono Mountain Water Supply company, Scranton, Pa.; Miami Power and Water company, Miami, Fla.; Short Hills Water company, Short Hills, N. J.; San Jacinto Water company, San Jacinto, Cal.; Lowell Land and Water company, Whittier, Cal.; Pennsylvania Water company, Ottawa, O.; Coalinga Water company, Selma, Cal.; Anerfour Water company, Walesburg, Col.; Indiana Water company, New Albany, Ind.; Croville Water and Power company, Croville, Cal.

CONTEMPLATED WORK.

Brinkley, Ark.—Municipal water works are assured.

Houghton, Mich.—A new water works pump will be purchased.

Ogden, Utah—An ordinance providing for water meters is proposed.

Franklin, N. Y.—This village has voted to increase the water supply.

Fort Worth, Tex.—Bids are invited for improving the water supply.

Ennis, Tex.—A new system of water works will probably be built.

Monroe, Mich.—The water mains will be extended for fire protection.

Merced, Cal.—The establishment of a water works system is contemplated.

Tamaqua, Pa.—About $50,000 will be expended in improving the water works.

Peekskill, N. Y.—Bonds will be issued for a new water main to Charles Point.

Sultepec, Mex.—Bids are desired for a water supply, according to press reports.

Puyallup, Wash.—The question of an increased water supply is being considered.

Lancaster, N. Y.—This village voted to issue bonds for new water mains.

Corsicana, Tex.—The water supply company will extend its system to East Corsicana.

Marine City, Mich.—The question of improving the water works is being considered.

Gananoque, Ont.—Plans for water works are being made by Willis Chipman of Toronto.

Randolph, Neb.—This village has voted to issue $4,500 bonds for improving the water works.

Augusta, Ga.—The Augusta Development company contemplates building water works in a few days.

Hull, Que.—The question of expending $55,000 for a new pumping station will be voted on.

Jefferson, Wis.—A system of water works is contemplated for the county poor farm.

Brooklyn, N. Y.—A system of water mains for Flatbush, to cost $35,000, has been ordered.

Grossdale, Ill.—Plans are being made for water works. They will be put in under the new Wood law.

Ada, Minn.—Plans are being prepared for a water works system, and bids will be asked next spring.

Grand Forks, B. C.—About $30,000 will be expended for improving the water works and electric light systems.

Cleveland, O.—Bids will probably be asked this season for two pumping engines of 25,000,000 gallons each.

Tannersville, N. Y.—Propositions are desired at once for furnishing a water supply by the village president.

Elyria, O.—L. E. Chapin, C. E., estimates the cost of a lake water works system at $195,531.

Allentown, Pa.—An ordinance appropriating $60,000 for the extension of the water works system has been passed.

Summerville, Ga.—This village contemplates the improvement of its water works by the addition of a steam pump.

Arnprior, Ont.—Plans have been completed for a water works and sewerage system; estimated cost, $39,000.

Sonoma, Cal.—Plans and specifications for a municipal water system are being made by City Engineer Von Geldern.

Georgetown, Del.—Efforts are being made to have the city officials take steps to put in the proposed works at once.

Charleston, S. C.—Specifications have been completed for a new water supply and electric lighting plant. Mayor Smith.

Salineville, O.—The question of making certain improvements, at an estimated cost of $4,000, is contemplated. W. W. Trustees.

Geneva, N. Y.—Plans are about completed for a new 9,000,000 gal. reservoir and other improvements. C. F. Church, cy. engr.

Newport, Ark.—Surveys for the proposed water works and sewerage system will be made by S. A. Mitchell of Kansas City, Mo.

Girard, O.—The proposition made by H. B. Shields, A. B. Camp and F. Krehl to put in a water works system has been accepted.

Sacramento, Cal.—Rudolph Hering, C. E., New York City, estimates the cost of testing the underground water supply at $2,000.

Monmouth, Ill.—D. W. Mead, Chicago, has been engaged to superintend the construction of the proposed water works, according to report.

Akron, O.—The Akron W. W. company will issue $400,000 bonds. The present pumping capacity will be doubled and the water mains extended.

Philadelphia, Pa.—The question of increasing the city debt by $12,000,000 for the improvement and extension of the water supply will be voted on in November.

Cleveland, O.—Plans and specifications for the Kirkland pumping station are being prepared, and bids will be asked soon. M. W. Kingsley, supt. W. W.

Beaver Falls, N. Y.—The People's Water company has decided to bond its plant for $35,000 for extending the water mains and constructing a reservoir.

Boulder, Col.—The purchase of the Jasper reservoir is proposed for an increased water supply. Edward Hubbard, Eugene Austin, Lon Johnson, councilmen.

Lancaster, Pa.—The question of constructing a filtration plant and otherwise improving the water works will be voted on in November. E. S. Smeltz, cy. clk.

Philadelphia, Pa.—The council's committee on water has approved the estimate of the bureau of water for 1900, $3,335,994, of which amount $1,753,000 is for extensions.

Norwich, Conn.—The committee appointed to investigate the possible increase of the city's water supply has been empowered to employ a civil engineer to aid it in its investigations.

Talladega, Ala.—A report has been submitted by the committee on water supply recommending that the city erect and maintain a new system of water works at a cost not to exceed $30,000.

Youngstown, O.—E. Sherman Gould is making an investigation of the feasibility of a plan suggested by a number of local citizens for a pure and adequate water supply for all purposes.

Chicago, Ill.—Plans and specifications for a high pressure water system in the downtown streets within three-quarters of a mile of the river are being made by City Engineer Ericson.

Elizabeth, Pa.—The Elizabeth Water company contemplates the construction of a pipe line at a cost of $100,000 and other improvements, including the completion of the filter plant, at a cost of $15,000.

Birmingham, Ala.—The Birmingham Water company will make extensive improvements in its South Highland service by the erection of a high pressure station, including a stand pipe, a pumping station, etc.

Denver, Col.—The ordinance authorizing the submission to vote of the question of municipal water works has been signed by Mayor H. V. Johnson. The question will be voted on Nov. 7; estimated cost, $4,700,000.

Cedar Rapids, Ia.—The council has served notice on the Cedar Rapids Water company, whose 20-yr. franchise expires Feb. 19, 1900, that it must sell to the city at a reasonable price or the city will build an independent plant.

Randolph, Neb.—(Special.)—This village has voted to issue $4,500 bonds for water works improvements, including a 12 by 60 in. steel stand pipe to replace the old tank. Improvements in pumping facilities, power and other improvements are contemplated. Plans and specifications are being prepared by Arnold C. Koenig, engr., Grand Island, Neb.

Minneapolis, Minn.—Estimates have been submitted by City Engineer Sublette for the proposed new pump station at Thirty-seventh-ave., N. E., and the river. The cost of the building will be $41,473, and the whole cost of installation and operating for a year will be $394,273 for steam power and $425,373 for electric power. In each estimate is included $200,000, the cost of 4 miles of steel intake pipe connecting with the river above Rice creek. This can be reduced to $50,000 by the use of wooden pipe.

The construction of water works is contemplated at the following places: Thomson, Ga.; Eldorado, Ark.; Phoenix, Ala.; Milford, Utah; Masontown, Pa.; Perrysburg, O.; Bridgewater, S. D.; Covington, O.; Longview, Tex.; Brown Valley, Minn.; Richland, Ia.; Brown's Valley, Minn.; Clarion, Ia.; Olivia, Minn.; Stanley, Wis.; Phenix City, Ga.; Lebanon, N. J.; Canton, Minn.; Mechanicsville, Ont.; Capron, Ill.; Graettinger, Ia.; Beeville, Tex.; Canton, Minn.

The question of issuing water works bonds will be voted on at the following places:

Jackson, Ga., Nov. 23; Tyrone, Pa., Nov. 7; Hillsboro, N. D., Nov. 14; Lancaster, Ky., Nov. 7; Philadelphia, Pa.; Thomson, Ga.;; Girard, O.; Wimbledon, N. D.

The question of issuing water works bonds has been favorably voted on as follows: Newell, Ia.; Las Vegas, N. Mex.; Lima, N. Y.; Collinwood, O.; Albion, Neb.; Armada, Mich.; Ackley, Ia.; Alva, O. T.; Tempe, Ariz.

CONTRACTS TO BE LET.

Concepcion, Chili.—Bids are asked until Jan. 3 for water works. Address Chilian Govt., Santiago de Chili.

Muskogee, I. T.—Bids are asked until Nov. 13 for building water works. W. R. Shackleford, recdr.

Helena, Mont.—Sealed bids are asked until Nov. 6 for the construction or purchase of a water plant and supply. Edw. Horsky, cy. clk.

Tampico, Mex.—Bids are desired until Feb. 15 for a water works and sewerage system and macadam paving. Neill E. Pressly, U. S. Vice-Consul, Tampico.

Highlands, Ky.—Bids are asked until Nov. 8 for the privilege of laying water pipe and supplying water to Highlands district. William H. Band, secy. bd. trus.

Warrington, England.—Bids are asked until Nov. 11 for constructing a covered concrete reservoir, lined with bitumen, of 4,400,000 gals. capacity. J. Lyon Whittle, clk.

Chicago, Ill.—Bids are desired until Nov. 15 for constructing the iron work to the proposed addition to the Chicago-ave. pumping station. L. E. McGann, comr. pub. wks.

Glenville, O.—Bids are asked until Nov. 15 for furnishing and laying 7,200 ft. of 12-in. pipe, including valves, hydrants, etc. H. W. Leighton, prest.

Martin's Ferry, O.—Bids are asked until Nov. 2 for furnishing and erecting a 4,000,000 gal. vertical compound condensing high-duty pumping engine and fixtures. T. E. Pugh, secy. bd. w. w. trus.

CONTRACTS AWARDED.

Lancaster, N. Y.—This place voted to grant a franchise to the Crystal Springs Water company of Buffalo.

Liberty, Mo.—A twenty-year water works franchise and contract has been granted to Ward M. Latson of this city.

Leslie, Mich.—T. C. Brooks of Jackson secured the contract for the water works system for this place for $1,500.

Buffalo, N. Y.—The Standard Water Meter company, New York City, secured the contract for a supply of water meters for about $10,000.

St. Paul, Minn.—The contract for furnishing six tons of ⅝-inch lead pipe has been awarded to the Crane-Ordway company at $5.34 a hundred weight.

Allentown, Pa.—The Holly Manufacturing company, Lockport, N. Y., has been awarded a contract for an 8,000,000 gallon pump for $26,870, exclusive of foundations.

Ballston Spa, N. Y.—The contract for building the receiving reservoir and for pipe laying was awarded to Harrington & Besch, Troy, for $10,621.40.

New Albany, Ind.—T. Lindsay Fitch, Louisville, Ky., has been granted a twenty-five-year water works franchise. The ordinance provides for a contract with the city for 220 fire hydrants at $50 each a year.

Livonia, N. Y.—Contracts for furnishing materials and building water works have been awarded as follows: Pipe and castings, Warren Foundry and Machine company, $9,564; hydrants, valves, etc., Rensselaer Manufacturing company; pipe laying and reservoir, Rosser & Castoe.

BRIDGES.

Dubuque, Ia.—The question of building a bridge at Eagle Point is being considered.

Grand Island, Neb.—The question of building four bridges across the Platte river will be voted on.

Sioux City, Ia.—The city engineer is preparing plans for a new wagon bridge on the Sergeant Bluffs road.

New Castle, Ind.—Sealed bids are asked until Nov. 7 for building a steel bridge. White Heaton, chrmn. comrs.

Malvern, Ark.—The county court has appropriated $10,000 for an iron bridge across the Ouachita river.

Lancaster, Pa.—The viewers have decided to build a bridge across the Cocalico at Bonman's farm. Franklin Brusaker, mem. com.

Webb City, Mo.—The Commercial Club appointed a committee, Oct. 21, to ask the county court to build a bridge across Center creek.

Ozark, Ark.—Bids are asked until Nov. 15 for building a steel bridge across the Mulberry river. B. W. Webb and J. T. Greer, comrs.

Mianus, Conn.—A committee has been appointed to investigate the matter of building an iron bridge. C. D Allyn, mem. com.

Trenton, Mo.—Bids will be received until Nov. 6 for a bridge across Wolf creek, and repairing the bridges. P. S. Vannatta, br. comr.

New Haven, Conn.—Secretary of War Root has ordered the construction of a new bridge to replace the present structure over West River at Kimberley-ave.

Denver, Col.—Chief Engineer Jones has been instructed to prepare plans for the proposed bridge to span Cherry creek at S. Fourteenth-st.

Quincy, Ill.—A new wagon bridge will be built on the Missouri side of the river midway between the West Quincy depot and the river bridge.

Alameda, Cal.—Sealed bids will be received until Nov. 14 for building a double draw-span bridge across tidal canal at Fruitvale. W. H. Heuer, maj. engrs., San Francisco.

Houston, Tex.—Engineer Weddell of Kansas City, Mo. has pronounced the San Jacinto-st. bridge defective and advises the construction of a new one. I. Austin Miller, cy. engr.

Decatur, Ind.—Sealed bids will be received until Nov. 6 for building a bridge. Each bidder will be required to submit plans, specifications and strain-sheets. J. E. Mann, chrmn. co. comrs.

North Canaan, Conn.—This town has voted to build iron or wood bridges over Blackberry river at Paul's bridge, at a cost not to exceed $2,000. J. N. Van Deusen, 1st. selectmen.

Anderson, Ind.—The Northwestern Scraper company of this city, secured bridge contracts, Oct. 18, as follows: Hendricks-st., $785; Thirteenth-st., $1,100; Fifteenth-st., $1,450; steel arch for Adams twp., $175.

Chicago, Ill.—The department of public works will ask the city council for an appropriation of $5,498,700 for building new bridges and viaducts and repairing present structures during the next year.

Marion, Ind.—Bridge contracts have been awarded in this county as follows: Lafayette Bridge company, two; Indiana Bridge company, two; Massillon Bridge company, two; Attica Bridge company, one, and Wabash Bridge company, one.

Indianapolis, Ind.—Sealed bids are asked until Nov. 6 for the construction of stone masonry and a steel bridge across Fall creek, at Illinois-st.; for Bedford stone arch bridges and concrete and steel arches across Fall creek at Meridian and Illinois-sts. M. A. Downing, chrmn. B. P. W.

Indianapolis, Ind.—Bridge contracts were awarded Oct. 13 as follows: Wm. Fife, stone work on seven bridges: Crooked creek, $7.90 a sq. yd.; Dry run, $7.90; Buck

creek, at New Pethel, $8.45; Pleasant run, $7.45; Eagle creek, $7.70; Dollarhide lake, $8.90; Buck creek, at Southport, $7.75. Substructure of Indian creek brodge, Wrought Iron Bridge company, $8.40 for stone and $7.85 for gravel concrete; superstructure of Indian creek bridge, W. E. Moore, $1,328; Crooked creek, $980, and Dry run, $945, Columbus Bridge company; Buck Creek, at New Bethel, Harris, Pfeiffer & Co., $1,584; Pleasant run, Columbus Bridge company, $796; Eagle creek, Lafayette Bridge company, $1,715; Dollarhide creek, Harris, Pfeiffer & Co., $960; Buck creek, at Southport, Wrought Iron bridge company, $1,000; Crooked creek, Lafayette Bridge company, $1,580. Contracts were awarded Oct. 27 as follows: Wooden bridge over Fall creek, east of Hammond's grove, Conrad Bender, $2,674; stone work, Capitol Paving company, $8.75 a cu. yd.; bridge over Brady's branch, Indianapolis Bridge & Iron works, $470; steel work, Henry W. Tielking, $7.80 a cu. yd.; bridge over Indian creek, New Columbus Bridge company, $459; stone work, Wm. Fife, $6.70; abutments for Buck creek bridge, southeast of Acton, Wm. Fife, $6.45.

PARKS.

Washington, D. C.—The sum of $40,000 is asked for the use of the parking commission.

Jersey City, N. J.—The Women's club is soliciting the aid of Mayor Hoos in securing a park on the lowland.

Middletown, O.—The question of issuing $100,000 bonds for the purpose of providing grounds for park purposes was voted on Oct. 23. L. P. Smith, mayor.

Philadelphia, Pa.—The council's committee on city property divided, Oct. 18, the $50,000 appropriation for small parks as follows: Clarence H. Clark park, $10,000; Fotterall Square, $10,000; John Dickinson Square, $10,000; McPherson park, $7,000; Juniata park, $7,000; Vernon park, $3,000; Gorgas park, $3,000.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Canton, O.—A garbage disposal plant will be built soon.

Lancaster, Pa.—Plans will be prepared for a crematory; estimated cost $10,000.

Minneapolis, Minn.—Council has appropriated $21,600 for a garbage crematory.

Winnipeg, Man.—The question of establishing a crematory will be voted on in December.

Washington, D. C.—The sum of $200,000 is asked for sprinkling, cleaning and sweeping streets.

Galveston, Tex.—The construction of two garbage disposal plants, is contemplated by the city council.

Cleveland, O.—The Cleveland Cremation company has been incorporated by Cecil L. Saunders, R. H. Fetterman and A. F. May.

Greensburg, Pa.—A franchise has been granted to H. A. Rugh, Harry Thomas and Harry Furtwangle for a crematory.

Lima, O.—A contract has been awarded to the Ohio Sanitary company, for the removal of all garbage, refuse, etc.

Altoona, Pa.—An ordinance authorizing the construction of a garbage crematory is being considered by the council.

Atlanta, Ga.—A proposition has been submitted by Venable Bros. to remove and dispose of the city's garbage and refuse.

Cleveland, O.—A committee has been appointed to secure information pertaining to street cleaning by the Waring system. Frank Billman, chrmn. com.

Milwaukee, Wis.—The Eagle Sanitary Cremation company, Des Moines, Ia., has been awarded the contract for the erection of a garbage plant on Jones's island, for $57,800.

Sioux City, Ia.—An ordinance passed to second reading, Oct. 10, granting to the Iowa Clean Street company, a 10-yr. franchise for maintaining waste paper boxes in the city's streets.

Hamilton, O.—The committee is investigating crematories and securing information preparatory to building one in this city. Mayor Bosch and Messrs. Hemp, Helvey and Lohman compose the committee.

Albany, N. Y.—Amended specifications for bids for the collection and disposal of garbage by cremation have been submitted. The action of council in appropriating money for the work is awaited.

Sydney, N. S. W.—Bids will be received until Nov. 3 for the construction of 1, 2, 3 and 4 refuse destructors, and for constructing and maintaining a destructor and working it for a period of seven years. John R. Palmer, town clk.

St. Paul, Minn.—Assemblyman Albrecht and Alderman Knault have been appointed by Mayor Kiefer to act with the recently appointed committee in securing information for a garbage disposal plant. Health Commissioner Ohage, City Engineer Clausen and Comptroller McCady, com.

New York City.—Contracts were awarded for collecting street sweepings and household refuse in Queens borough, as follows: First ward, 31,200 tons, Magnus Larsen, Astoria, L. I., $1.90; Second ward, 9,700 tons, Carde & Monteverde, Elmhurst L. I., $1.98; Third ward, 15,300 tons, Magnus Larsen, $2.65; Fourth ward, 12,000 tons, Thomas Foley, Jamaica, L. I., $2; Fifth ward 12,400 tons, S. N. Decker, Far Rockaway, L. I., 98 cts.

STREET LIGHTING.

Cincinnati, O.—This city has not abandoned the proposed return to gas lighting.

East Dubuque, Ia.—The erection of an electric light plant is contemplated.

Bethel, Me.—A company is being organized to build an electric light plant, according to press reports.

Pinckneyville, Ill.—A franchise for an electric light plant has been granted G. W. Brown.

Albion, Pa.—The town council has passed a resolution for an electric light plant.

Charleston, S. C.—Specifications have been prepared for an electric lighting plant. Mayor Smyth.

Braidentown, Fla.—The construction of an electric light plant is contemplated. H. W. Fuller is interested.

McKeesport, Pa.—The question of building a municipal electric light plant is being considered.

Reynoldsville, Pa.—A. E. Ferrin has petitioned council for a franchise for an electric light plant.

Bridgeport, W. Va.—About $6,000 will be expended in improving the plant. Electric light com.

Lansdowne, Pa.—The contract for electric lighting for five years has been awarded to the Lansdowne Electric company.

Topeka, Kas.—A franchise for constructing a gas plant has been granted W. J. Faulkner of Chicago.

Grayslake, Ill.—The organization of a stock company to put in an electric light plant is being considered.

Atlanta, Ga.—The contract for lighting the city for three years has been awarded to the Georgia Electric Light company.

Austin, Minn.—The contract for an electric light plant was awarded, Oct. 11, to W. I. Gray & Co. of Minneapolis for $12,000.

Knoxville, Pa.—The Knoxville electric company has been formed to erect an electric and ice plant in this town. C. D. Wood, secy.

Middletown, Ind.—A committee has been appointed to investigate the question of building an electric light plant. F. W. Cooper.

Iron Mountain, Mich.—An engineer has been employed to prepare an estimate of the cost of building an electric light plant.

Port Allegre, Brazil.—Bids are asked until Dec. 31 for electric lighting in this city. Commercial Dept., Foreign Office, London, England.

Jeffersonville, Ind.—The Wayne Construction company, Ft. Wayne, Ind., secured the contract for furnishing a lighting plant for this city for $47,000.

Defiance, O.—A franchise has been granted Will V. Coons, for furnishing eighty arc city lights for a period of ten years at $75 each per year.

Wiliamsport, Pa.—The contract for lighting the streets for five years was awarded to the Lycoming Electric company at $74.50 per light.

Council Bluffs, Ia.—Sealed bids will be received until Nov. 6 for lighting the city with electric light for a term of fifteen years. N. C. Phillips, cy. clk.

Royersford, Pa.—The town council decided recently to do away with electric street lighting, and the streets are now lighted with gas or gasoline.

The question of issuing electric light bonds has been favorably voted on as follows: Newton Falls, O.; Greenport (L. I.), N. Y.; Tower, Minn.; Ludlow, Ky.

Brooklyn, N. Y.—Deputy Commissioner Walter of public buildings, lighting and supplies, has asked for $994,061.70 for lamps and lighting in this borough.

The question of issuing bonds for building electric light plants will be voted on at the following places: Loowellville, O.; Hastings, Neb.; Hilsboro, N. D., Nov. 14.

Linwood, O.—The charter for linghting the streets with electric lights will expire Jan. 1, after which it is proposed to use Welsbach burners instead of electricity.

Northville, Mich.—The contract for the erection of the new municipal electric lighting plant has been awarded to the Northville Construction company for $27,000.

The establishment of electric light plants is contemplated at the following places: Milford, Utah; Dysart, Ia.; North Wilkesboro, N. C.; Confluence, Pa.; Iron Mountain, Mich.;

Columbia, S. C.—Bids are asked until Nov. 13 for furnishing 175 arc lights of 1,200 c. p. each for a period of 5 yrs. T. F. Talley, cy. trus.

Norfolk, Va.—Bids are desired until Nov. 22 for lighting the city for a term of three years. Jas. A. Ridgwell, chrmn. lgt. com. of coun.; E. L. Mayers, chrmn. lgt.

Peoria, Ill.—A compromise was reached between the village of North Peoria and the Peoria Light & Power company, by which the price of lighting has been reduced from $78 per light per annum to $67.50.

Middleton, Ind.—J. N. Barnard, secretary, has been instructed to correspond with manufacturers of electrical supplies, construction companies, etc., with a view to ascertaining the probable cost and other details regarding a suitable plant for this town.

Eckington, Va.—Commissioner Wight has suggested that the number of incandescent electric lights be reduced and the number of gas lamps increased, on account of the unsatisfactory service rendered in lighting this place with incandescent lights.

St. Paul, Minn.—Bids are asked until Nov. 2 for electric, gas or gasoline lighting in certain streets and public buildings. Mat. Jensen, cy. clk.

Warren, Ill.—An ordinance is before the village board, asking for a 20-yr. franchise to operate an electric light system at $80 per lamps per year for not less than five arc lamps of 2,000 c. p. and $16 per lamp per year for 270 incandescent lamps.

Lincoln, Neb.—The contract with the Lincoln Gas company, by which it agrees to reduce the price for gas, was accepted, Oct. 9. The company agrees to charge not more than $1.92½ per thousand cu. ft., for illuminating gas and $1.50 for fuel gas. Also, to reduce the price of its product 7½ cents per thousand feet on the first of each October until 1905.

Xenia, O.—The contract for lighting the streets was awarded, Oct. 13, to the Xenia Electric Light company, at $53 a lamp per year. A temporary restraining order was issued Oct. 16, against further action on the part of the council in the awarding of the contract. It is alleged that the bid of the Xenia Electric Light company, was accepted when a lower bid, $59.90 per lamp, was offered.

Electric light companies have been incorporated as follows: Roachdale Electric Light and Telephone company, Roachdale, Ind.; Wenona Light and Power company, Wenona, Ill.; Haddon Gas Light company, Collingswood, N. J.; Philadelphia Electric company, Philadelphia, Pa.; Leoben Incandescent Light company, Camden, N. J.; Thriumph Electric company, Cincinnati, O.; Citizens Light and Manufacturing company, Nunda, Ill.

TOO LATE FOR CLASSIFICATION.

New Albany, Ind.—New bids will be asked for paving Market-st. with brick.

Two Rivers, Wis.—Bids are desired until Nov. 7 for a sewerage system. A. B. Leyse, cy. clk

Bainbridge, Ga.—Bids are asked until Nov. 15 for building a water works system. E. J. Willis, mayor.

Galveston, Tex.—Bids are desired until Nov. 6 for two garbage furnaces with equipments. Geo. Q. McCracken, secy. b. p. w.

Opelika, Ala.—Sealed proposals are asked until Nov. 6 for lighting this city for a term of 5 to 10 yrs. J. W. Williams, jr., chrmn.

Anderson, Ind.—About $25,000 will be expended in enlarging the electric light plant. Elliott Lee, chrmn. electric light com.

Ada, Minn.—Plans have been prepared for a water works system and bids will probably be received about Feb. 1. F. M. Calkins, rec.

Niles, O.—Bids have been received for asphalt paving and sewers in Furnace and Mill-sts., but the contracts have not yet been awarded.

Norfolk, Va.—Sealed bids are asked until Nov. 22 for lighting this city with electricity for a term of 3 yrs. E. L. Mayor, chrmn. lgt. com.

Chicago, Ill.—Bids are asked until Nov. 24 for design, manufacture and erection of four single track and one double track steel highway bridges over Illinois and Michigan canal near Tiskilwa and Wyanet, Ill. W. L. Marshall, maj. engrs.

Baraboo, Wis.—A 2,000,000 gal. pump and a 60-in. by 16-ft. boiler will be put in by G. W. Maxey, receiver of the Baraboo water company.

Ft. Worth, Tex.—Sealed proposals are asked until Dec. 1 for an increased water supply. John B. Hawley, cy. engr.; A. W. Scoble, supt. w. w.

Joliet, Ill.—Garbage crematory plants are being inspected by City Engineer Stevens and other city officers, preparatory to building one in this city.

Florence, Col.—The plans and specifications for a sanitary sewer, which were prepared by Hiram Phillips of St. Louis, Mo., have been adopted.

St. Joseph, Mo.—City Engineer Rackliffe

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